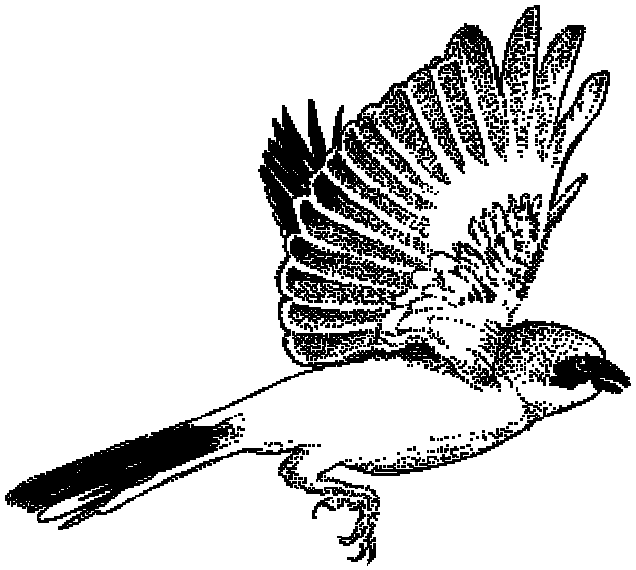
## APPENDIX I. BAER TEAM RESOURCE ASSESSMENTS

- **Cultural Resource Assessment**
- **Threatened and Endangered Plant Resources Assessment**
- **Vegetation Resource Assessment**
- **Wildlife Resource Assessment**
- **Soil and Watershed Assessment**
- **Operations Assessment**



Loggerhead Shrike
*U.S. Fish and Wildlife Service*

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**U. S. DEPARTMENT OF THE INTERIOR**
**BURNED AREA EMERGENCY REHABILITATION TEAM**

**24 Command Fire**

**CULTURAL RESOURCE ASSESSMENT**

## I. OBJECTIVES

- **!** Identify and protect previously recorded or documented prehistoric and historic cultural resources within the fire perimeter area.

- **!** Assess damage to known and documented archaeological sites, historic structures, and cultural landscape features from the effects of wildfire and suppression activities**.**

- ! Inventory areas disturbed by fire suppression activities and recommend treatments for those cultural properties adversely affected by suppression and rehabilitation actions.

## II ISSUES

- **!** Assessment of fire and fire suppression effects on previously documented cultural resources as well as those associated with rehabilitation of the 24 Command Fire.

- ! Protection of cultural resources from suppression-related effects

- **!** Inventory of cultural properties potentially affected by the wildfire and fire suppression activities;

- **!** Protection of prehistoric and historic archaeological resources, cultural significant locations, historic structures, and historic landscapes within the fire suppression and burned areas;

- **!** Evaluation, monitoring, or preservation treatments for cultural resources affected by fire, suppression, or rehabilitation activities.

## III OBSERVATIONS

### A. Background Information

The following information is derived from several widely available sources and is intended to be a cursory overview of present knowledge to provide a context within which the fire, suppression activity, post-suppression inventory, and recommended cultural resource prescriptions may be considered. Supporting documents are cited in the Reference, Part VI.

The 24 Command Fire occurred within an area known as the Pasco Basin Columbia Plateau. Much of the Columbia Plateau consists of a thick sequence of basalt that was formed during Miocene time by successive lava flows. Pleistocene cataclysmic floods, associated with the sudden release of water from ice-dammed Lake Missoula, are responsible for the morphology of the area. Over 40 such events occurred, scouring the basalt bedrock to lay down a relatively coarse-grained flood deposit over low-lying areas of the central Columbia Plateau. The final flood occurred at approximately 13,000 B.P. Within the burn area these sediments were windblown to create dunes and loess. Flooding has since been confined to the Hanford Reach of the Columbia River.

The Hanford Site and the Arid Lands Ecology Reserve (ALE) contain extensive archaeological deposits left by more than 10,000 years of human activity. The remains of pithouses, graves, spirit quest monuments, hunting camps, game drives, quarries, and hunting and kill sites are represented, as are the structural and archaeological remains of historic farming, ranching, and mineral exploitation. Over 190 cultural resource sites and isolated finds have been recorded within the 24 Command burn area. Two are listed on the National Register of Historic Places (NRHP). The Yakama, Umatilla, Nez Perce Tribes and the Wanapum People maintain cultural ties to the area.

The Columbia Plateau region has been formed by basalt flows, catastrophic flooding, and environmental flux. Prehistoric cultural subsistence systems have been shaped by these changing conditions. The early Holocene (ca. 10,000 years B.P.) was cooler and moister than present conditions. People at this time were probably quite mobile, concentrating on hunting activities. The environment became drier about 8,000 years B. P.; a pattern of seasonal subsistence collection of a wide variety of resources developed with a riverine base. With the return to a more moist and cool environment at approximately 4,500 years B. P. the regional culture began constructing house pits and had a hunter-gatherer subsistence pattern. There is a brief period (3,800 to 3,400 years B.P.) in the archaeological record for which no house pits have been found. When house pits reappear the hunter-gatherer lifestyle continues but with evidence for intensified food processing and food storage, thus setting the pattern for the Columbia Basin that remained into modern times.

Two archaeological districts, each containing numerous and mostly unrecorded prehistoric archaeological sites, have been identified on the ALE Reserve. Both of these districts are listed in the NRHP. Rattlesnake Springs Archaeological District includes sites 45BN170 and 45BN171. Snively Canyon Archaeological District includes sites 45BN172 and 45BN173.

Euro-Americans first came into the Hanford region with the Lewis and Clark expedition. They were followed by fur trappers, military units, and miners passing through on the major rivers. The lack of timber and fur-bearing animals, the apparently agriculturally unpromising soils, the presence of numerous, well established Indians, and the scorching summers were among the salient reasons that the area was not immediately settled by non-Indians.

Like the Indians along the Columbia and Yakima rivers, when the Euro-Americans did settle, they placed ranches and farms adjacent to these important irrigation sources and transportation corridors. By 1880 cattle ranches were established and the railroad soon arrived. The towns of Hanford, White Bluffs, and Richland thrived along the riverbanks in the early 20th century. Oil exploration was conducted in the Rattlesnake Mountain and Rattlesnake Hills area in the 1920's and 1930's, but useful deposits were not found. Natural gas was discovered on Rattlesnake Mountain in the 1920's but the deposits proved too small to be a major continuing economic force. The remains of numerous exploration sites and gas wells are scattered along the foot of Rattlesnake Mountain. The federal government acquired the land for the Hanford Engineer Works in 1943 and proceeded to evacuate all civilians (Indians and whites) from the area. Subsequent removal of much of the standing structures created a large historic archaeological district at the Hanford Site.

Two historic resources identified on the ALE have been determined eligible for listing in the NRHP; White Bluffs Road (H3-121) and the Nike Missile Anti-aircraft artillery (H-52-C and H-52-L). A segment of the White Bluffs Road runs through the northern portion of the ALE . This road was an important transportation and supply route between Yakima and a ferry

landing site on the Columbia River at White Bluffs. The route was used by settlers and traders as early as the 1860's, and may have been built on an existing trail used by the Native Americans.

Between 1955 and 1961 NIKE Ajax and Hercules missiles were deployed by the U.S. Army at four locations on the Hanford Site, three on the North Slope and one on the ALE. Of the four NIKE locations only the launch and radar control site (H-52-C and H-52-L) on the ALE remain intact. That site has been recommended as eligible for the NRHP as a significant complex due to their important association with the defense of the Hanford Site.

The United States Government acquired the land for a secure location to begin the large-scale production of plutonium, the material used in the world's first and third atomic bomb explosions. The efforts in research and development expended during the Manhattan Project at Hanford continued to influence developments during the Cold War period in plutonium production for national defense and non-defense nuclear applications, including energy production and human health and environmental restoration fields.

The Hanford Site and ALE is an important region to members of the Yakama, Umatilla, and Nez Perce Tribes, as well as the Wanapum People. Their ancestors resided on the land, utilized its resources and in so doing created a culture closely woven with the landscape. Several properties on the ALE have been identified as culturally significant by the tribes.

**Table CR.1 24 Command Fire Cultural Resource Advisors**

| Name | Home Office | Work Period |
|---|---|---|
| Michael Boynton | USFS Columbia River Gorge NSA | 6/30 to 7/7 |
| Nicholas Valentine | USFWS Region 1Cultural Resources Team | 7/1/to 7/7 |
| Bob Hazelbrock | Pacific Northwest National Laboratory | 7/3 to 7/5 |

### B. Reconnaissance Methodology

Protection of human life and property from wildfire takes precedence over the protection of historic and prehistoric cultural properties. However, the diminishing numbers of archaeological sites, traditional cultural sites and resources of cultural importance representing millennia of human life must be provided protection whenever possible.

The protection of cultural resources did not appear to be a priority during initial suppression of the 24 Command Fire. The explosive spread of the fire and the very limited cultural heritage personnel available prevented any effective intervention during suppression. Cultural resource assessment and protection efforts did not begin until the arrival of the BAER Team in Richland, Washington on June 30, 2000.

U.S. Forest Service Archaeologist Michael Boynton, Columbia River Gorge Natural Scenic Area, Oregon was dispatched as a member of the 13 person BAER Team. Fire perimeter orientation, and overview flights occurred on July 1, 2000. Nicholas Valentine, Archaeologist from U.S. Fish and Wildlife Service Region 1 and Bob Hazelbrock, Archaeologist Pacific Northwest National Laboratory, Richland, Washington assisted in subsequent cultural resources records check and field review.

BAER policy recognizes cultural resources as a critical resource requiring assessment and protection. A guiding principle as well as a legal requirement of burned area rehabilitation is to regard archaeological sites and other materially fragile cultural resources when proposing emergency rehabilitation treatments. If post-fire conditions indicate erosion threats or other actual or potential watershed problems, cultural resources must receive special attention to ensure that their unique and irreplaceable values are given full consideration.

Incident-related damages to cultural resources fall in two broad categories: fire-related and suppression-related. Fire-related impacts include thermal fracture of obsidian, basalt, chert, granite and other stone artifacts, destabilization or destruction of structures and features. Other impacts include destruction of organic elements in an occupational or midden deposit, destabilization of soils within a site or landscape with resultant increased erosion and deflation of loosened sediments, and increased susceptibility to looting and surface collection due to greater visibility.

Suppression related impacts occur with disturbance or destruction from dozer or hand line construction, use of sites for fire camp or equipment staging. Rehabilitation activities also may cause impacts, including restoration of dozer and hand lines, silt basin construction, restoration of range and forest land, and replacement of infrastructure.

## C. Findings

The 24 Command Fire cultural resource assessment addresses possible effects to a minimum of 190 previously recorded historic and prehistoric archaeological sites. These sites range from lithic scatters to can scatters, Indian hunting sites to ranch buildings, spirit quest monuments to gas production wells. As many of these sites can occur within the same physical space rehabilitation can be quite complex. The preliminary assessment of fire effects on known cultural resources was significantly hindered by the lack of ready access to the cultural resource

At the heart of this problem is the fact that the major portion of the 24 Command Fire occurred on the Arid Lands Ecology reserve (ALE). Management of the ALE was recently acquired by FWS. Although copies of site forms, survey maps and other cultural resource records have been requested of the previous ALE land managers, those records have not been transferred to FWS. Hence, retrieval by BAER personnel of specific site location and description data in a timely manner was impossible. Access to the database was provided on July 3 by a PNNL archaeologist, however this was not in time to assist in the field review phase of the cultural resource assessment. Complete site assessments must await the cultural resource inventory of the previously documented sites within the burned area, and the compliance surveys performed in advance of the variety of rehabilitation actions recommended in the BAER Plan.

A preliminary inventory of pre-historic and historic sites on the ALE was conducted by archaeologists assigned to the BAER team on July 1 and July 2, 2000. Of the 19 sites marked on maps in the Smithsonian trinomial system 8 were visited. Two other locations were noted in transit and inspected. Subsequent review of site maps indicated that one of these locations had been recorded as several sites but none were issued trinomial site numbers. One site appears to have be an unrecorded spirit quest monument. The second location has components from several periods of occupation, including many fragments of depression era glass. The glass had not been melted, spalled, shattered, or otherwise severely altered by the fire. This observation was also noted for lithic debris at prehistoric sites. However, wood structures, such as a corral, were apparently destroyed by the fire.

Overall, the area burned at a low severity. The fire was wind-driven through cheatgrass and sage, and did not dwell long enough to completely consume all vegetation or to create hydrophobic soils. Fine plant roots were usually observed immediately below the surface, indicating that the organic composition of the soil and consequently of archaeological sites has not been affected to a significant extent.

## IV. RECOMMENDATIONS

Three specifications were prepared to address known and potential effects to cultural resources. These specifications may be accomplished by force account, contract or inter-agency agreement. The specifications address potential affects and specific rehabilitation needs for properties damaged by the fires, inventory and assessment of previously recorded cultural resources, and law enforcement monitoring of sites exposed by the removal of vegetation. The inventory of previously uninventoried areas in advance of ground disturbing activity for other rehabilitation projects will be accomplished under the compliance process for those undertakings. At this writing no subsurface deposits appear to have been damaged or are threatened by post fire erosion. Therefore no archaeological site data recovery is recommended at this time.

**A. Management** (specification related)

**C-1b Cultural Resources Damage Assessment - Suppression**

A field inventory of locations disturbed by the fire suppression effort, or areas with the potential to be effected by rehabilitation activities will be undertaken to identify potential effects to cultural resources. Evaluation of those effects and development of necessary mitigation or treatment plans will be undertaken as required.

**C-1a Cultural Resources Damage Assessment - Fire**

A complete cultural resource field inventory and evaluation of previously recorded and documented sites within the area burned by the 24 Command Fire will be accomplished. The product will be a condition assessment for cultural resource compliance and rehabilitation purposes. Site stabilization measures will be developed and implemented as warranted.

**B. Monitoring** (specification related)

**S-1 Public Safety: Protect Cultural Resources**

The ALE and the burn area is officially closed to the public. The visibility of sensitive historic and prehistoric cultural materials has been increased in the wake of the 24 Command Fire. Due to the propensity for looters to operate within areas exposed by fire, selected historic and prehistoric archaeological sites and localities will be patrolled to monitor and deter site looting and vandalism.

**C. Management** (non-specification related)

Post suppression rehabilitation of vegetation through planting of seeds or container plants has the potential to effect historic and prehistoric cultural properties. As specific revegetation plans are developed they must be reviewed by agency archaeologists, Tribes, and consultation with the State Historic Preservation Officer must be documented.

Specifications for rehabilitation undertakings must include Section 106 compliance, and include specific provisions for the protection of identified cultural resources. The contractor

must be informed of areas to be avoided by flagging or UTM locations, and of the requirement to follow specific site treatment requirements. Inspectors must be responsible for monitoring and documenting compliance. Archaeological monitors may be required at specific locations. Monitors should have direct contact with the Contracting Officers Representative to ensure compliance with the cultural resource protection requirements.

The FWS and DOE should pursue a mutually agreeable method for the sharing of cultural resource information and ready access to records for sites formerly under DOE jurisdiction and now under FWS management. The development of a shared GIS cultural resources layer should be a priority undertaking in order to provide site information to archaeologists and land managers in a timely manner for future emergency events.

Given the significant cultural resources of the area, a temporary cultural resource position should be established to monitor the implementation of the specifications for cultural resources and rehabilitation specifications developed by other disciplines within the Hanford Reach National Monument and the Arid Lands National Wildlife Refuge Complex.

Post fire surface visibility has greatly enhanced the ability to identify surface expressions of archaeological sites. There is an opportunity to refine the boundaries of known sites, define archaeological districts and to locate new sites. In addition, as fire in the area was a natural occurrence throughout human occupation of the area there is an opportunity to study this fire's effects on known culturally significant resources and in the archaeological record.

The locations and expressions of archeological sites can not be determined with certainty. If in the course of any rehabilitation or restoration activity cultural resources are discovered all work in the vicinity must stop and the appropriate agency archaeologist consulted.

## V. CONSULTATIONS

Table CR.3 Consultations Concerning the 24 Command Fire.

| Date | Contact | Type | Action | Response |
|---|---|---|---|---|
| 1 July | Johnson Meninick, Yakama Tribe | Fax | notice of BAER work | none |
| 1 July | Lenora Seelatsee, Wanapum Tribe | Fax | notice of BAER work | none |
| 1 July | Antone Minthorn, Umatilla Tribe | Fax | notice of BAER work | none |
| 1 July | Samuel Penney, Nez Perce Tribe | Fax | notice of BAER work | none |
| 4 July | Johnson Meninick, Yakama Tribe | Fax | CR treatment plans | none |
| 4 July | Lenora Seelatsee, Wanapum Tribe | Fax | CR treatment plans | none |
| 4 July | Antone Minthorn, Umatilla Tribe | Fax | CR treatment plans | none |
| 4 July | Samuel Penney, Nez Perce Tribe | Fax | CR treatment plans | none |
| 5 July | Rob Whitlam, Washing SHPO | Fax | CR treatment plans | comments provided |
| 5 July | Dee Lloyd, PNNL | Fax | CR treatment plans | meeting on 6th |
| 5 July | Darby Stapp, PNNL | Fax | CR treatment plans | meeting on 6th |

| | | | | |
|---|---|---|---|---|
| 5 July | Kevin Clark, DOE | Fax | BAER Handbook Ch.1., July 5th correspondence | none |
| 5 July | Johnson Meninick, Yakama Tribe | Phone | CR treatment plans | Not available. Contacted Sandra Kiona |
| 5 July | Richard Buck, Wanapum Tribe | Phone | CR treatment plans | comments provided |
| 5 July | Rex Buck, Jr., Wanapum Tribe | Phone | CR treatment plans | left message |
| 5 July | Jeff van Pelt, Umatilla Tribe | Phone | CR treatment plans | left message |
| 5 July | Jason Lyons, Nez Perce Tribe | Phone | CR treatment plans | No longer employed by tribe. Left message for Vera Phonic |
| 5 July | Rob Whitlam, Washington SHPO | Phone | CR treatment plans | comments provided |
| 5 July | Dee Lloyd, PNNL | Phone | CR treatment plans | comments provided |
| 5 July | Darby Stapp, PNNL | Phone | CR treatment plans | comments provided |
| 5 July | Greg Cleveland, Yakama Tribe | Fax | CR treatment plans | comments provided |
| 6 July | Rex Buck, Wanapum Tribe | Fax | Invitation to closeout | |
| 6 July | Samuel Penney, Nez Perce Tribe | Fax | Invitation to closeout | |
| 6 July | Antone Minthorn, Umatilla Tribe | Fax | Invitation to closeout | |
| 6 July | Lonnie Selam, Yakama Tribe | Fax | Invitation to closeout | |
| 6 July | Kevin Clark, DOE | Fax | Above July 5th correspondence | |

## VI. REFERENCES


2000, *Establishment of the Hanford Reach National Monument*. Presidential Proclamation 7319.

1998, *Handbook of North American Indians,* Volume 12: Plateau. Walker, Jr. Deward (Editor) Smithsonian institution, Washington.

1996, Draft *National Register of Historic Places Multiple Property Documentation Form. Historic, Archaeological and Traditional Cultural Properties of the Hanford Site, Washington* Prepared for U.S. Department of Energy, Richland Operations Office by Battelle Pacific Northwest National Laboratory

N.D., *EE.II Hanford Area Land Use A Historical Perspective.* M.S. Gerber, Ph.D



Michael Boynton, Heritage Resource Program Manager, U.S. Forest Service, Columbia River Gorge National Scenic Area, (541) 308-1711. Email address: **mboynton/r6pnw_crgnsa@fs.fed.us**

Nicholas Valentine, Archaeologist-Museum Specialist, U.S. Fish and Wildlife Service, (503) 625-4887. Email address: **nick valentine@fws.gov.**

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**U. S. DEPARTMENT OF THE INTERIOR**
**BURNED AREA EMERGENCY REHABILITATION TEAM**

**24 Command Fire**

**THREATENED AND ENDANGERED PLANT RESOURCES ASSESSMENT**

## I. OBJECTIVES

- Identify and locate threatened and endangered plant species impacted by fire and/or suppression actions.

## II. ISSUES

- Determine impacts of fire to one federally listed and eight state listed threatened, endangered and sensitive plant species and/or habitat.

## III. OBSERVATIONS

Emergency consultation was held with the U.S. Fish and Wildlife Service (USFWS) on July 3, 2000 for threatened and endangered (T&E) species known to occur within the 24 Command Fire area in Richland, Washington. A current USFWS species list and a State of Washington species list was obtained on July 3, 2000 by the Deputy Project Manager of the USFWS Arid Lands Ecology (ALE) Refuge Complex. One federally listed plant species was identified and eight previously inventoried state listed species were known to occur within the fire area. Contacts were made with local experts to determine if additional sensitive species of concern were potentially affected by the fire and suppression actions.

Washington State listed species known to occur within the fire area will be discussed within this assessment due to management guidelines and policies administered by the USFWS and Department of Energy (DOE) for the impacted lands. All planning documents covering the ALE focus on the preservation and protection of the shrubland-steppe as a primary management goal. Current management direction provides for the protection, monitoring and recovery of federally listed and state listed threatened, endangered, and sensitive species. T&E plants will be discussed separately in order to better document current information regarding habitat and fire effects to each species.

A complete list of Washington State T&E plant species that occur within the Hanford Project Area is included within Appendix V. Species on this list that are not discussed below have been eliminated from analysis in this assessment as they are not known to exist or have not been mapped within the fire area.

### A. Background

Refer to Vegetation Assessment.

### B. Reconnaissance Methodology and Results

On July 3, 2000 emergency consultation was initiated with the USFWS- ALE to verify documented T&E species (flora and fauna) within the fire area. A current species list was obtained and provided to the BAER Team vegetation and wildlife specialists. At that time it

was confirmed that the list contained one federally listed T&E plant species and eight known state listed species within the fire area that occur in Benton County, Washington.

On July 3, 2000 the BAER Team Vegetation Specialists met with natural resource staff from the USFWS, Arid Lands National Wildlife Refuge Complex Office and the DOE, Pacific Northwest National Laboratory Office to obtain baseline habitat and location information pertaining to known T&E plant species.

The species identified within the fire area include:

| | | |
|---|---|---|
| Ute ladies'-tress | *Spiranthes diluvialis* | Federally listed- Threatened |
| Bristly cryptantha | *Cryptantha spiculifera* | State listed- Sensitive |
| Piper's daisey | *Erigeron piperianus* | State listed- Sensitive |
| Coyote tobacco | *Nicotiana attentuata* | State listed-Sensitive |
| Dr. Bill's locoweed | *Astragalus conjuctus var novum* | State listed-Review Group 1 |
| Columbia milkvetch | *Astragalus columbianus* | State listed-Threatened |
| Desert evening-primrose | *Oenothera caespitosa* | State listed-Sensitive |
| Camissonia | *Camisonia pygmaea* | State listed-Threatened |
| Gray Cryptantha | *Cryptantha leucophaea* | State listed- Sensitive |

A comparison was made between the known locations of the above listed species and the vegetation mortality map (Appendix III) in order to determine direct fire effects. A review was also conducted using the Fire Effects Information System (FEIS) at the National Interagency Fire Center to determine known effects on these species. A review of the FEIS system was conducted on July 5, 2000 and showed that no current information is recorded within this data base pertaining to known fire effects.

Additionally, on July 5, 2000 the Vegetation Specialist held discussions with staff of the ecology group of the Pacific Northwest National Laboratory to discuss known effects to any of these species. Fires have periodically burned within the Hanford area and on ALE. Some research is currently underway on the ALE where a portion of Yakima Ridge burned in 1998 however the data have yet to be compiled and evaluated. To date, no known comprehensive studies have been conducted to document fire effects on the currently listed T&E species within these shrub-steppe plant communities.

Outlined below is a brief synopsis of the associated habitat(s) for the listed species and potential fire impacts to each:

<u>Ute ladies'-tress</u>:

Habitat: Ute's ladie's-tresses is a perennial terrestrial orchid which generally requires a symbiotic association with mycorrhizal fungi for seed germination. This is a lowland species that typically occurs beside or near moderate gradient, medium to large streams or rivers in the transition zone between the mountains and plains. Soil moisture for this species must be at or near the surface throughout the growing season.

Findings: Based upon the above habitat requirements and a search of available T&E field inventory data, suitable habitat for Ute ladies'-tress does not occur and this plant has not been found to exist within the fire area. Therefore a NO EFFECT determination has been made for this species.

Bristly cryptantha

Habitat: Bristly cryptantha ranges from central Washington and eastern Oregon to northeastern California and northern Nevada, east throughout the Snake River Plains of Idaho and western Montana where it generally grows in dry, open sites often in stony and shale soils. Four known populations are located in the Hanford site and are associated with big sagebrush, Sandberg's bluegrass and winterfat plant communities.

Findings: Direct fire effects to the known habitat of this species was minimal. Located within a mosaic burn area of the fire, fire intensities were low and the mapped location of this species may have been within unburned islands of fuel. Potentially there could be the loss of above ground vegetative portions of this species, however the growth cycle for this plant had concluded for this growing season and it is anticipated that no long-term detrimental effects will occur. Other direct fire effects to this species are unknown at this time. Monitoring of post fire populations will be needed in order to determine any detrimental impacts to the species.

Piper's daisey:

Habitat: Piper's daisey occurs in the winterfat/Sandberg's bluegrass plant community type and in big sagebrush/bluebunch wheatgrass communities. This species often occupies south-facing slopes of undisturbed areas of the sagebrush steppe. Populations of this species on the Rattlesnake Mountain area were observed to be thriving during the BAER team's assessment work on the fire.

Findings: Direct fire effects to the known habitat of this species was varied. Some populations were located within the mosaic burn areas of the fire. In these areas, fire intensities were low with many plants still blooming and thriving. In other populations within the fire area, 75-100% of all vegetative species were burned as a result of high fire intensities. Above ground portions of shrub, grass, and forb species had been removed by the fire which will change the characteristics of the plant association, (species diversity, percent bare ground, soil temperatures, etc.) for many years. Long-term fire effects to this species and the relationship it has with associated vegetation types are unknown at this time. Monitoring of post-fire populations will be needed in order to determine any detrimental impacts to the species.

Coyote tobacco:

Habitat: Coyote tobacco is currently known to exist within the big sagebrush/Sandberg's bluegrass plant association. This species was recently found to exist within the fire area however an inventory conducted in the spring of 2000 did not re-locate plants observed the prior year.

Findings: It currently is unclear as to the exact location of this species within the fire area. The last reported siting of this plant is within a mosaic burn area where fire intensities were low and some unburned islands of vegetation remain. Adjacent stands of big sagebrush were adversely impacted however, whereby 75-100% of shrub, grass, and forb species had been

removed by the fire which will change the plant association characteristics, (species diversity, percent bare ground, soil temperatures, etc.) for many years. Additional field inventories are needed to pinpoint the exact location of this species within the burn area and post-fire monitoring will be required in order to determine fire effects to this species.

Dr. Bill's locoweed:

Habitat: Dr. Bill's locoweed is scattered in bunchgrass areas along the main ridges of Rattlesnake Mountain. The population includes several tens of thousands of plants however the population is presently incompletely mapped. This species is known to exist entirely within the boundaries of the ALE Reserve.

Findings: Direct fire effects to the known habitat of this species was varied. Some populations were located within the mosaic burn areas of the fire where fire intensities were low with many plants still blooming and thriving. The north slope of Rattlesnake Mountain contains many small islands of unburned vegetation and the south slope plant communities were observed to be unburned. Plant communities below the 2,000 foot elevational line were more severely impacted as 75-100% of all vegetative species were burned as a result of high fire intensities. Above ground portions of shrub, grass, and forb species were removed by the fire which will change the plant association characteristics, (species diversity, percent bare ground, soil temperatures, etc.) for many years. Long-term fire effects to this species and the relationship it has with associated vegetation types are unknown at this time. Monitoring of post-fire populations will be needed in order to determine any detrimental impacts to the species and population size.

Columbia milkvetch:

Habitat: Columbia milkvetch is a local endemic and is found in Yakima, Kittitas, and Benton Counties in south-central Washington. It was once thought to be extinct but has since been found to be relatively common within its limited range. Most of the Hanford populations grow in the big sagebrush/ bluebunch wheatgrass and big sagebrush/ Sandberg's bluegrass plant associations mostly in well-drained sandy and gravelly loams, lithosols, and cobbly sand most frequently found in early seral stage plant communities following disturbance.

Findings: Primary populations of Columbia milkvetch have been mapped in the Yakima Ridge area. Recovery from a 1998 wildland fire that impacted this area has been slow resulting in limited fine fuel accumulations within the inter-spaces of these plant communities. During the 24 Command incident, fire intensity was low and vegetative losses were minimal as the fire burned in a mosaic fashion. Satellite imagery will be available in approximately 2 weeks from the approval date of this plan and can be utilized to do more intensive vegetative mapping of fire effects to the habitat of this species. Long-term fire effects and the relationship this species has with its associated vegetation types are unknown at this time. Monitoring of post-fire populations will be needed in order to determine any detrimental impacts to the species.

Desert evening-primrose:

Habitat: Evening-primrose is a perennial that favors dry, open habitats, occurring as individuals or colonies on clay soils, rocky slopes composed of shales, volcanic, sandstones, bluffs, and exposed rocky ridges.

Findings: This species is known to occur in the Yakima Ridge area of the fire on steep talus slopes. During the 24 Command incident, fire intensity was low and vegetative losses were minimal as the fire burned in a mosaic fashion. Talus slopes on Yakima Ridge appeared unburned due to the loss of fine fuels within these areas during the 1998 fire. Monitoring of post-fire populations will be needed in order to determine any detrimental impacts to the species.

Camissonia:

Habitat: Camissonia is a perennial forb that favors dry, open habitats, occurring on stony soils, basalt blocks, cobbles with silt, sand and caliche fragments. The surrounding plant community is bitterbrush/Sandberg's bluegrass.

Findings: This species is known to occur in the Yakima Ridge area of the fire on south-facing slopes. During the 24 Command incident, fire intensity was low and vegetative losses were minimal as the fire burned in a mosaic fashion. Southerly slopes on Yakima Ridge burned at a very low intensity due to low litter layers which were removed during the 1998 fire. Monitoring of post-fire populations will be needed in order to determine any detrimental impacts to the species.

Gray cryptantha

Habitat: Gray cryptantha grows on swales and slopes of somewhat to moderately well vegetated sand dunes and other sandy habitats. It is usually associated with the bitterbrush/Indian rice-grass dune coples plant association.

Findings: Gray cyptantha has been mapped near the central landfill on DOE however populations are believed to exist across the entire dune area. Monitoring of previously mapped, post-fire populations will be needed in order to determine any detrimental impacts to the species.

## III. Indirect Effects

Indirect effects are those that may occur or are anticipated to occur which may either be beneficial or detrimental to the species. As discussed above, long-term monitoring of T&E species will be required in order to better quantify the effects of the 24 Command Fire on each species and its related habitat.

Indirect detrimental effects to these species could result from competition from invasive plant species, potential loss of soil productivity due to wind erosion, loss of seed viability when exposed to the elements.

However, it is important to note that beneficial effects may assist some species in their recovery or provide opportunities for species enrichment. In those areas where fire

intensity was low and the fire burned in a mosaic fashion, some benefits to T&E species may be derived. These benefits may result from: the release of nutrients back into the soil profile; a reduction in competition for soil nutrients, sun, and soil moisture from other perennial species for the first 1-2 years during the recovery period; and the re-establishment of plants from roots and soil seedbanks. It was noted that all of the state listed T&E species are forbs which had completed their life cycle for this growing season. Although the fire burned at varying intensities across the landscape, in most cases the residency time of the fire was short enough so as not to damage the soil, existing root systems, or reduce native seed banks in the known habitats of these plants.

Close monitoring of the known sites of T&E species with careful documentation of effects will be important to gain a better understanding of the fire effects to these species within the affected plant associations. Monitoring work is also needed to comply with Agency mandates for the protection and prevention of unacceptable degradation of T&E species. It is imperative that USFWS and DOE staff input collected data into the existing FEIS system to ensure that fire effects data is available in the future for these species.

## IV. RECOMMENDATIONS

### A. Management (specification related)-None

### B. Monitoring (specification related)

**1.** M-1a- Monitor T&E Plant Species Recovery: Conduct short-term monitoring (2 years) on known locations of *Astragalus columbianus, Cryptantha interrupta, Erigeron piperianus, Nicotiana attentuata,* and *Astragalus conjunctus var novum* within the fire area to determine fire effects on these species. Surveys should be conducted by both jurisdictions in a cooperative manner to determine fire effects on these species and their post-fire recovery potentials.

## V. CONSULTATIONS

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**U. S. DEPARTMENT OF THE INTERIOR**
**BURNED AREA EMERGENCY REHABILITATION TEAM**

**24 Command Fire**

**VEGETATION RESOURCE ASSESSMENT**

## I. OBJECTIVES

- Evaluate and assess fire and suppression impacts to vegetative resources and identify values at risk associated with vegetative losses.
- Determine rehabilitation and monitoring needs supported by specifications to aid in vegetative recovery and soil stabilization.
- Evaluate potentials for invasive species encroachment into native plant communities within the fire area.
- Provide management recommendations to assist in vegetative recovery, watershed stabilization, site productivity and species habitat protection and rehabilitation.

## II ISSUES

- Suppression effects and short/long-term impacts to plant communities and vegetative resources within the 24 Command Fire on federal, county, private, and state lands.
- Protection and enhancement of other resource values including site productivity, wildlife habitat, vegetative resources, cultural resources and watershed stability.
- Management strategies which provide for the stabilization, natural regeneration and recovery of impacted areas.
- Monitoring of the planting/seeding effectiveness of rehabilitation efforts.
- Monitoring of impacted lands for the early detection and control of invasive and noxious weed species.

## III. OBSERVATIONS

This report identifies and addresses known and potential impacts to vegetative resources within the 24 Command Fire in Richland, Washington.

The burned area consists of approximately 164,000 acres of riparian and Columbia Basin shrub-steppe plant communities. Vegetative resources provide forage and cover for a variety of wildlife species, aesthetic values, watershed stability, and biologically diverse plant associations. The impacted plant communities serve as the largest remaining example of the contiguous expanse of native sagebrush/bunchgrass communities in the State of Washington and globally.

Findings and recommendations contained within this assessment are based upon information obtained from personal interviews with land managers, resource specialists, researchers, BAER Team specialists, literature research, and field reviews of the fire area.

Reconnaissance of impacted areas included aerial and ground survey methods. This assessment will attempt to capture the concerns expressed by staff from the US Fish and Wildlife (USFWS), Department of Energy, and the general public. Many entities have been impacted by this fire and all have demonstrated a cooperative spirit and concern for the future management of these lands. This report will detail the known damage to vegetative resources; will discuss revegetation processes and future monitoring criteria; and will outline management considerations for recovery of the vegetative resources.

## A. Background

The 24 Command Fire began on June 27, 2000 near the Yakima barricade on the Department of Energy's (DOE) Hanford Site as a result of an automobile accident. Fueled by erratic winds, extreme day-time temperatures and dry fuel conditions, the fire spread quickly throughout the Arid Lands Ecologic Refuge (ALE) and the Central Hanford Area.

Vegetative resources were extensively impacted by this fire on federal, county, private and tribal lands. As detailed later in this report, fire impacts ranged from total loss of understory species, varying degrees of loss in shrub plant communities, to the total removal of all plant communities.

Concerns expressed by federal, state, county and private sources concerning vegetative resources include: vegetative loss and the short and long term impacts to wildlife habitat, microbiotic crusts, ecological integrity of the shrub-steppe plant associations, noxious weed and invasive species encroachment, archaeological resources, watershed stability, site productivity, aesthetics, public safety, impacts to threatened or endangered plant and animal species, and potential long-term affects to the shrub-steppe ecosystems.

Plant associations within the fire include sagebrush/bunchgrass, sagebrush/cheatgrass, Bitterbrush/bunchgrass, winterfat/bunchgrass, Black greasewood/alkali saltgrass, and abandoned agricultural fields dominated by forbs and annual grass communities. Topography, aspect, and elevation dictate the variability of the vegetative communities within the fire area as well as the soil textures and depths.

At more than 360,000 acres, the Hanford Site is one of the largest contiguous pieces of shrub-steppe habitat remaining in the Columbia Basin. The uniqueness and biological diversity of the area was formally recognized by Presidential Proclamation 7319 on June 9, 2000 establishing this area as the Hanford Reach National Monument. The monument as been described as a "biological treasure" that embraces important riparian, aquatic and upland shrub-steppe habitats that are rare or in decline in other areas. Within the area is a mosaic of habitats that support a wealth of increasingly uncommon native plant and animal species which is unmatched in the Columbia Basin. Because of the high diversity of native plant and animal species, the large number of rare and sensitive plant species, the well developed microbiotic crusts and significant breeding populations of nearly all steppe and shrub-steppe dependent species, the USFWS has been tasked to preserve and protect these objects of antiquity in perpetuity.

The Hanford Reach land base, originally established in 1943 by the US Government as a national security area for the production of weapons-grade plutonium has restricted public access and has been free of agricultural influences for over four decades. This area has preserved the habitats of, and now serves as a refuge for, various native plants and animals.

## B. Reconnaissance Methodology and Results

On June 30, 2000 , the Interagency BAER Team assembled at the ALE Office in Richland, Washington to begin rehabilitation assessments. On June 30 & July 1, 2000 the Vegetation Specialist met with representatives from USFWS and DOE to obtain issues and objectives for emergency rehabilitation actions, baseline information pertaining to known impacts and information related to vegetation resources. Upon consultation with local staff, and after reviewing the burned areas within the fire perimeter, direct fire impacts have been documented for all plant communities.

Aerial reconnaissance of the burned area was conducted on July 1 and again on July 4, 2000 to map burn intensity and vegetation mortality and to determine and document losses of vegetative resources. The fire burned in a mosaic fashion on approximately 15% of the fire area. Due to extremely dry conditions and high winds, vegetation resources were significantly reduced on approximately 85% of the fire area. That is, standing biomass of shrubs, grasses, and forbs were 90-100% consumed over 85% of the fire area.

Field reconnaissance of the fire was conducted between July 1 - July 4 with the aide of local resource experts. Each plant association type was inspected to determine vegetative losses, requirements for rehabilitation efforts, recovery potentials, and long-term rehabilitation needs. Observations were made of fire impacts to duff layers, live crown tissue on grass and shrub species, and on impacts of the fire to existing seed banks.

A literature review was conducted to obtain baseline data on soils, hydrologic processes, plant communities, invasive species establishment potentials and the importance of vegetative species. The ALE is one of the most researched land units in the Columbia Basin with extensive background studies and reports available. Many well written documents exist that detail historic and present day vegetation descriptions. Excerpts from these documents have been included to provide the reader with a better understanding of plant community structure and provide insight into the fragility of these ecosystems.

### 1. Vegetation:

The 24 Command Fire burned approximately 164,000 acres of federal and private lands in and around the communities of Richland and Benton City, Washington. Due to extreme fire behavior, fuel conditions, topography, and weather varying amounts of vegetative cover was lost.

The diversity and vast size of native plant communities found on the Hanford Site is unmatched in the ecoregion. Biodiversity inventory personnel and the Washington Natural Heritage Program identified a total of 17 terrestrial, native plant community types (or elements) that occurred as 48 separate element occurrences on the ALE Reserve and North Slope. The terrestrial element occurrences covered approximately 90,000 acres, occupying significant amounts of the ALE Reserve. The condition and size of the big sagebrush (*Artemisia tridentata*) / bluebunch wheatgrass (*Pseudoroegneria spicata*) on the ALE Reserve, and the bitterbrush (*Purshia tridentata*) / Indian ricegrass (*Oryzopsis hymenoides*) and big sagebrush / needle-and-thread (*Stipa comata*) dune complex occurrences on the North Slope and Central Hanford are extensive and of particular regional importance.

Primary plant communities impacted by the fire included the following plant associations:

Big Sagebrush/bluebunch wheatgrass: This community type is characterized by big sagebrush (*Artemisia tridentata)*, bluebunch wheatgrass (*Psuedorogneria spicata*), Sandberg's bluegrass (*Poa secunda)*, diverse forbs, and where relatively undisturbed, a robust microbiotic crust. This community is widely disbursed throughout the region in loamy soil types although it is frequently associated with a understory cover of cheatgrass.

Big Sagebrush/Sandberg's bluegrass: This community type is characterized by big sagebrush, Sandberg's bluegrass, spiny hopsage *(Grayia spinosa)* and low forb diversity. The plant community type is generally confined to locations too dry for bluebunch wheatgrass on soil that is finer-textured than is typical for needle-and-thread associations.

Big Sagebrush/Needle-and thread: Big sagebrush is the dominant shrub, although bitterbrush *(Purshia tridentata)* commonly occurs at varying levels. Thickspike wheatgrass *(Agropyron dasystachum)* may occur in the understory. Where intermixed with bluebunch wheatgrass, needle-and-thread is thought to increase with disturbance.

Bitterbrush/ Indian ricegrass dune Complex: This community type occurs on active dunes and other extremely sandy soils. Primary species include bitterbrush, Indian ricegrass *(Oryzopsis hymenoides*), often with cheatgrass and tumbleweeds.

Big Sagebrush/Cheatgrass: This community is primarily composed of Big sagebrush with an understory dominated by cheatgrass *(Bromus tectorum).*

Black Greasewood/Alkali saltgrass: This plant community is composed of greasewood (*Sarcobatus vermiculatus)* and alkali saltgrass (*Distichilis stricta).*

Winterfat/Sandberg's bluegrass: This plant community is primarily composed of winterfat *(Eurotia lanata*) and Sandberg's bluegrass. Overall species diversity is low, however the rare plant Piper's daisy (*Erigeron piperianus)* frequently occurs.

Three-tip Sagebrush: At the higher elevation of the ALE Reserve, three-tip sagebrush (*Artemisia tripartita)* begins to co-occur with or replace big sagebrush as the dominant shrub with bluebunch wheatgrass as the primary understory graminoide species.

Willow Riparian Complex: This riparian community is characterized by diverse shrubs and trees that include a substantial component of willow (*Salix)* species. Within the fire area it was observed in the Rattlesnake Springs, Snively Canyon, Benson Springs, and Yakima River areas.

The above list of plant communities is a very simplified accounting of the major plant communities that have been impacted by the 24 Command fire area. Species diversity within each of the major community types has been altered in some areas due to the activities of neo-European people that entered the region beginning 200 years ago. In more recent history, alien plants were introduced and established a foot-hold in the shrub-steppe communities with the advent of livestock grazing in the mid-1800's and through agricultural cultivation and urbanization later in the century.

Vegetation within this area has also been altered through the establishment of cheatgrass within sage communities and the shortening of the natural fire return interval. Historically, fire return intervals were between 50-100 years in the shrub-steppe region. Fires burned in

a mosaic fashion across the landscape leaving many healthy remnant stands of bunchgrass and sage. The mosaic fire patterns allowed for the survival of healthy sage communities and habitat for wildlife species. However, as witnessed in the 24 Command fire, an increase in fine fuels in the understory sagebrush communities created a condition for a large, high intensity event on approximately 85% of the fire area.

Within the Big sagebrush and Three-tip sagebrush communities, cheatgrass provided ladder fuels for fire to quickly spread into and throughout these stands. In areas where native bunchgrass dominated the understory, fire impacts to some shrub stands were greatly reduced.

In order to better quantify impacts to vegetation, four mortality classes were developed and utilized to map the fire area. The four classes developed were:

Class 1: Remnant stands intact
Class 2: 25-50% Vegetative losses
Class 3: 50-75% Vegetative losses
Class 4: 75-100% Vegetative losses

Using these four mortality classes, the vegetation specialist took into account the impacts of the fire on grass, forb, shrub, and tree species. In some areas where the fire moved very quickly through a sagebrush stand, understory vegetative losses may have been classed in the 50-75% category whereas actual shrub losses may have been less. The intent of mapping vegetation in these classes was to determine impacts to wildlife habitat, native plant associations and their recovery ability, watershed stability, and potential treatment recommendations. On July 5, 2000 a satellite image of the fire area was shown to the vegetation specialist by DOE Ecosystem Monitoring personnel. This image will be useful in further refining the vegetation mortality map contained within this plan and determining additional study sites, rehabilitation treatment measures or restoration goals for some sagebrush plant community areas.

Observations of sagebrush and native bunchgrass communities were made to determine fire effects to native species. Acreage totals and vegetation loss estimates are outlined in TABLE A below for major plant associations:

**TABLE A:**

| Species | Acres w/in Fire Perimeter | Remnant (Acres) | 25-50% loss (Acres) | 50-75% loss (Acres) | 75-100% loss (Acres) |
|---|---|---|---|---|---|
| **Big Sagebrush** | 53,713 | 8,600 | 9,096 | 10,901 | 25,116 |
| **3-Tipped Sage** | 10,382 | | 9,909 | | 473 |
| **Bitterbrush** | 1,437 | 7 | | 11 | 1,409 |
| **Greasewood** | 298 | | | 298 | |
| **Bunchgrass/ Cheatgrass** | 3,300 | | | | 3,300 |
| **Bluebunch wheatgrass** | 28,144 | | | | 28,144 |
| **Willow Riparian** | 44 | | | 14 | 30 |
| **Winterfat** | 1,102 | | | | 1,102 |
| **Needle-and-thread** | 593 | | | 593 | |

Vegetation resources provide valuable wildlife forage and habitat, watershed protection, and comprise a visually pleasing landscape. The effects of this fire will have both positive and negative short and long-term influences on these plant communities and in the natural regeneration processes of the impacted watersheds.

**2. Vegetation/Structural Impacts**

Vegetation resources were directly impacted by the 24 Command Fire and by suppression tactics utilized to control the fire. Documented impacts to vegetation resulted from:

a) Construction of dozerline on previously undisturbed sites and the grading of 2-wheel track roads on ALE.

b) Impacts to native shrub, and grass species during line construction, suppression and mop-up activities.

c) Reduction of fuels and vegetation ahead of the fire-front (backfire operations).

d) Vegetation losses due to fire intensity. Most sagebrush communities were completely consumed and/or scorched. Some additional loss is expected within remaining shrub communities.

e) Loss of the organic litter layer on approximately 95 percent of the fire.

f) Impacts to riparian vegetation by fire effects on riparian species.

g) Loss of sagebrush plantations established in 1998 and 1999 through backfire operations.

h) Damage to structural improvements, (e.g. boundary fence) by suppression actions. Fences were cut or damaged through backfire operations. (Detailed information and locations available within Operations Assessment).

i) Impacts to established research plots throughout ALE.

Generally speaking, most sagebrush and bunchgrass communities experienced greater than 75% vegetative loss. On approximately 85% of the fire area, complete consumption of vegetative resources was observed. Most shrub, grass and forb species and organic material on the soil surface was consumed indicating extreme fire intensity.

The vegetation specialist tested the soils for hydrophobicity in several sagebrush plant communities to determine if a water repellant layer was present in the soil. On sagebrush sites where the sage was estimated to be 30- 50 years old, a hydrophobic layer existed for approximately two inches into the soil surface. It is believed that this layer was present due to the amount of accumulated organics at the base of the shrub and the presence of cheatgrass. When the soils were tested in the interspaces between shrubs, where a well developed microbiotic crust existed, there was absolutely no water repellence. This observation is relevant only in the fact that cheatgrass accumulation acted as a ladder fuel to ignite the sagebrush. Historically, sagebrush burned in a more mosaic fashion without entire stands being consumed. The hydrophobic layer was created through the intense heat and residency time of the fire in these areas. This example of hydrophobicity was limited in scope (please refer to Watershed Assessment of detailed evaluation of burn severity) throughout the fire area.

Due to the fact that the fire moved so quickly with a low burn severity, seed bank sources in the soil were not adversely impacted. That is, the seed bank within the soil will serve to naturally regenerate sage and native bunchgrass species. Recovery times of sagebrush will be dependent upon growing conditions and precipitation patterns over the next several years. Recovery is expected to take between 5 to 10 years to establish a visible sagebrush cover on the landscape. However, some sage communities may not recover or be replaced by other species (i.e. *Artemisia tridentata with Artemisia tripartita).* Population sizes may have been adversely impacted and should be monitored over time to determine long-term fire effects.

A mosaic burn pattern was observed and mapped on approximately 15% of the fire area. Some remnant plant communities on Rattlesnake Mountain, Yakima Ridge, and near the LIGO facility on DOE are still intact.

Bunchgrass communities were impacted almost uniformly across the landscape. Except for the areas as described above in the mosaic burn areas, 90% of all bunchgrass species were burned. A random sample was made across ALE to estimate the survival rate of bunchgrass species. The vegetation specialist found a good age class distribution for bluebunch wheatgrass between plant communities. In the older bunchgrass stands, approximately 3-4 inches of burned biomass remained above the crown of the plants.

Individual plants were checked to determine if fire residency time had killed the crown. On older bunchgrass species, the center of the plant where litter accumulations were present burned at a higher intensity than the outside "ring" of the plant. Younger plants burn more uniformly across the crown due to low litter buildup in the center of the plant. In both cases, live crowns were still present on these species. Older plants will regrow as adequate moisture is received and will have a "halo" appearance. Younger plants are expected to readily recover.

As discussed within the T&E plant assessment, most forb species were consumed. Although the fire burned at varying intensities across the landscape, in most cases the residency time of the fire was short enough so as not to damage the soil, existing root systems, or reduce native seed banks in the known habitats of these plants.

Riparian areas within Snively, Rattlesnake Springs, and along the Yakima River experienced losses ranging from 50% to approximately 80% of riparian vegetation. Approximately 14 acres or 32% of the riparian areas along the Yakima River experienced 50-75% loss of riparian vegetation. Snively Springs and Rattlesnake Springs experienced a 75 -80% loss of riparian vegetation in and around the spring sources and along the stream channel. Concern has been expressed by tribal representatives concerning the impacts to remaining and recovering riparian areas by the elk population. Potentially, additional grazing or trampling impacts will occur to these areas due to the loss of the forage base for wildlife species on ALE. However this loss will be temporary in nature as willows and sedges will revegetate these areas over the next 2-3 years. Impacts to riparian areas by elk will be evaluated through monitoring efforts which will be conducted within the burn. This issue is discussed further within the Wildlife Assessment. Findings from monitoring actions will determine if additional rehabilitation treatments or mitigation measures are required for riparian recovery.

Ground disturbing impacts to ALE and DOE property came in the creation of fire breaks using bull dozers and graders. A complete inventory was conducted of dozerlines on the fire area and rehabilitation needs assessed. Roads within ALE that had revegetated over time were also opened up using graders and utilized as firelines and transportation routes for suppression personnel.

Negative impacts resulting from vegetation losses include a significant reduction in wildlife habitat, forage for wildlife species, visual quality degradation, increased non-native invasion potentials, bare soils, and reduced species diversity. The loss of wildlife habitat, and potential impacts to Threatened and Endangered Species are discussed further within the Wildlife Assessment.

Additional losses surveyed during field reviews were fire impacts on boundary fences. Boundary fence between ALE and private lands were negatively impacted. Stretch posts and wire were damaged by the fire and will require repair. Some repairs were completed by the Operations Specialists of the BAER team to secure boundary fences along US Highway 240. Additional repairs have been addressed within the Operations Assessment (Appendix I).

**B. Vegetation Recovery**

Revegetation of the fire area through natural processes will take between 3-7 years to visually represent pre-fire conditions. Some impacted plant communities will take decades to re-establish back to pre-fire levels. Most research indicates that fire will eliminate sagebrush for at least several years. Because big sagebrush reproduces by seed and not by sprouting, recovery can be very prolonged on many sites. In most cases, sagebrush

eventually returns. However, concern has been expressed about the re-establishment of critical sagebrush communities for agency listed T&E wildlife habitat and the protection of the ecological integrity of the shrub-steppe community. During the course of the fire, backfires were set (see Suppression Impact Map- Appendix III) to slow or stop the advancing fire front. In initiating this type of suppression action, shrub communities established through plantings in 1998 and 1999 were lost. As the backfire progressed on ALE and DOE lands, sagebrush communities established for restoration and mitigation purposes were consumed. Additionally, native shrub-steppe habitat was lost thereby creating potential short and long-term impacts to T&E plant and wildlife species.

Currently the USFWS and DOE have a cooperative outplanting program for sagebrush tublings. Approximately 80,000 plants have been propagated from locally collected native seed and are available for planting this fall. Rehabilitation work through the years at Hanford has shown that tublings have the best survival rate for rehabilitation over seeding or bare root stock plantings. In order to facilitate the recovery of critical wildlife habitat it is recommended that the Agencies cooperatively identify critical habitat needs and areas for outplanting of these tublings within the fire area this fall.

Additionally, in order to carry out the mission for the protection and preservation of the shrub-steppe communities in perpetuity it is recommended that USFWS and DOE work cooperatively to restore those plantations that have been lost through fire suppression activities. During the 2000 calendar year, it will be necessary to assess overall losses to sagebrush communities as a result of suppression actions; collect native seed for sagebrush propagation; and establish native outplanting stock for rehabilitation efforts.

One plant community comprised of Black greasewood was observed during field assessments. One-half of this plant community lost approximately 70% of standing shrubs whereas the other half, along the southern foothills of Yakima Ridge, suffered a 30% loss. This species had been mentioned as a species of concern for Native American Tribes. The thorns on this shrub are used for sewing. In order to determine potential effects to this population, the vegetation specialist consulted the Fire Effects Information System (FEIS) to understand fire impacts to this species. The current research indicates that greasewood generally sprouts vigorously from the stem base or roots following fire. Rapid resprouting may lead to an increase in stem density. A similar response may occur after the plant is partially killed by fire. Follow-up evaluations of the ALE population should be conducted to determine direct effects to this plant community.

It will be necessary to also assess and determine rehabilitation actions to be taken on dozerlines and road systems within ALE and DOE lands that were impacted by suppression actions. During the 2000 calendar year it will be necessary to finalize rehabilitation plans for dozerlines and suppression impacts to roads, collect native grass and shrub seed and establish native outplanting stock for rehabilitation efforts.

Other direct impacts to vegetation include the loss of shrub lands previously occupied by dense vegetation which are now open and traversable. Increased visitor/research use into areas off of designated road systems can be expected and could have negative impacts to wildlife, microbiotic crusts, vegetative recovery, and cultural resources. Impacts to natural regeneration process and the protection of cultural resources will be jeopardized if travel within the fire area is not regulated for the remainder of this calendar year.

Soil samples collected within the burn on July 2, 2000 were watered for a five day period during the BAER Team's assessment phase and on July 8, 2000 sprouted seedlings. This demonstrates that the seed bank within the fire area is still intact and will respond quickly to the first measurable preciptation.

Recovery of native plant communities, impacts of the fire on microbiotic crust, re-establishment of sagebrush, invasive species and noxious weed monitoring, and long-term fire effects to this Columbia Basin shrub-steppe ecotype within the region all present tremendous research opportunities. A tremendous interest has been expressed concerning research opportunities to tie treatment specifications with data collection to advance ecological knowledge for supporting management actions and decision making processes (refer to Washington State University letter dated July 7, 2000- Appendix V). The ALE has been designated as a Natural Research Area and thereby possess special characteristics and guidelines for research and study opportunities. A window of opportunity is now available for research plots within ALE and Central Hanford to be reactivated to capture baseline recovery data. However, this work must be closely coordinated to ensure that research efforts do not hinder site recovery or natural regeneration processes.

**1. Noxious Weed Establishment**

During the initial BAER Team briefing, the concern of invasive species introduction into the fire area was discussed with the vegetation specialist. Concern was expressed concerning species expansion on burned-over lands within ALE and Central Hanford.

The establishment of invasive species and noxious weeds which will compete with native vegetation recovery is likely. Noxious weed establishment and spread is most likely to occur on disturbed sites such as dozerlines and open road systems.

During field assessment inventories, the vegetation specialist recorded sightings of diffuse, spotted, and Russian knapweed; rush skeleton weed, and kochia. Each of these species is currently located along existing road systems or in unburned islands of vegetation within the fire. Most of the knapweed species are beginning to blossom and will set seed by the middle to end of July. It is imperative to treat known populations prior to seed-set in order to reduce the expansion potentials of these populations into the fire area. Immediate treatment of these populations is recommended.

Additionally, disturbed sites within the fire area should be inventoried by each respective management agency utilizing funds allocated within this plan. Each agency should establish their own monitoring protocols and ensure that surveys are conducted during the fall of 2000 and 2001 calendar year. Upon the discovery of new noxious weed populations, accurate population information should be collected through the use of Global Positioning Systems to determine infestation size, original source and potential control methods. Control efforts will be implemented in accordance with Agency management guidelines and protocols.

**2. Revegetation**

Concern has been expressed concerning the loss of vegetative cover on the sand dunes area of ALE and Central Hanford along Highway 240. Conversations with the Washington Department of Transportation (WDOT) have been held to express the BAER Teams concern over public safety during the next 3 years. Options were offered to WDOT (see Watershed Assessment) to allow natural regeneration processes to occur prior to seeding. However, revegetation of the sand dunes will be slow and will take many years to stabilize these areas. WDOT has expressed a desire for the federal agencies to revegetate these dunes this fall. USFWS and

DOE in conjunction with WDOT should continue to pursue this option and revegetate those areas as needed to protect public safety and critical natural resource values. Supplemental funding will be required as plans are finalized on treatment areas, methods, and locations.

## IV. RECOMMENDATIONS

### A. Management (specification related)

The following recommendations are offered to assist in the timely recovery of 24 Command Fire:

1. N-2: Non-native / invasive plant control- Control noxious weed infestations remaining within 24 Command fire area prior to seed-set and maturation. Current weed species observed include Rush skeleton weed, knapweed (diffuse, spotted, Russian), kochia and Canadian thistle. Utilize integrated pest management techniques (herbicides, biological, mechanical and cultural control methods) as appropriate to prevent the spread and establishment of noxious weeds within the fire area (N-.

2. N-3a: Ecological stabilization and sagebrush plantings - Replace sagebrush plantations (*Artemisia spp.)* lost during backfire operations on the 24 Command fire to protect ecological integrity of ALE and DOE lands.

3. N-3c: Ecogological Stabilization and Seed Collection- Collect seed from native sagebrush, bitterbrush, bunchgrass and greasewood populations for the establishment of nursery stock for rehabilitation efforts within the 24 Command fire area. Collection sites may be within Hanford, Ale, or adjacent project lands.

4. N-3b: Ecological Stabilization and Sagebrush Outplanting- In the fall of 2000, plant 80,000 sagebrush (*Artemisia spp.)* seedlings within the fire area to rehabilitate impacted shrub-steppe plant communities that serve as critical habitat for T&E species.

### B. Monitoring (specification related)

1. M-1a: Monitoring: Invasive Plant Species- Develop monitoring protocols and conduct field inventories on disturbed sites including but not limited to dozerlines, handlines, safety zones, and helibases to map, and initiate control measures on invasive species infestations that threaten native plant community recovery as discovered.

### C. Management Recommendations(non-specification related)

1. Initiate designated road closures within the 24 Command Fire area in order to prevent further road degradation, prevent the spread of noxious weeds and protect cultural resources.
2. Create informational articles for the public during the course of the rehab efforts to keep residents updated on progress. Continue to produce timely news releases to educate the general public about the shrub-steppe ecosystem developmental processes and recovery periods following fire.
3. Utilize the NRCS and RCD programs to assist with rehabilitation on private lands and information dissemination.
4. Establish a cooperative agreement with DOE for seamless implementation of rehabilitation treatments.
5. Finalize suppression damage inventories and initiate repairs to boundary fencelines and fire control lines.
6. Establish photo trend/vegetation monitoring plots in 2000 and 2001 to document vegetative recovery in each plant association within the fire area.
7. Evaluate sand dune rehabilitation in an interagency forum and develop additional seeding needs cooperatively.
8. Initiate a call-out for research proposals that will aid both agencies with data collection for long-term rehabilitation decision making.

## V. CONSULTATIONS

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**U. S. DEPARTMENT OF THE INTERIOR**
**BURNED AREA EMERGENCY REHABILITATION TEAM**

**24 Command Fire**

**WILDLIFE RESOURCE ASSESSMENT**

## I. OBJECTIVES

- **!** Assess effects of fire and suppression actions to Threatened, Endangered, Proposed and other significant agency listed species and their habitat, including birds, mammals, amphibians, reptiles, fish and insects.
- **!** Initiate Emergency Section 7 Consultation as required by the Endangered Species Act.
- **!** Assess effects of fire and suppression action to habitat improvements.
- **!** Assess effects of proposed emergency rehabilitation actions to listed species and habitat.
- **!** Prescribe emergency rehabilitation measures and/or monitoring.

## II. ISSUES

- **!** 14 agency listed species occur within the fire area, most of which are dependent on the shrub-steppe plant community.
- **!** Potential effects to these species from the fire, suppression actions and potential post fire effects to down stream species.
- **!** Potential effects to these species from proposed emergency rehabilitation actions.

## III. OBSERVATIONS

### A. Background

The purpose of this Burn Area Emergency Rehabilitation (BAER) Wildlife Assessment is to document the effects of the fire, suppression actions, proposed emergency rehabilitation work, and potential post fire flooding, to all federally listed, agency sensitive and culturally significant mammals, birds, amphibians, reptiles, fish, invertebrates, and their habitats which may occur within or downstream from the fire area. This assessment also includes documentation on Emergency Section 7 Consultation, as required by the Endangered Species Act, with U. S. Fish and Wildlife Service and National Marine Fisheries Service. The species list is included on page 13 of this report. This species list was developed by Heidi Brunkal, Wildlife Biologist, U. S. Fish and Wildlife Service (FWS), Arid Lands National Wildlife Refuge Complex (ALNWRC), and Larry Cadwell, Staff Scientist, Pacific Northwest National Laboratory (PNNL). Species occurrence discussed in this assessment is based on formal surveys and habitat inventories conducted prior to the 24 Command Fire, and post fire reconnaissance. Documents, inventory data, sighting records, vegetation maps and other species specific information referenced in this report are on file at the ALNWRC and PNNL offices.

The 24 Command Fire burned approximately 163,884 acres between June 27 and July 1, 2000. This fire was ignited by a vehicle accident the afternoon of June 27. By the evening of June 28, the fire had burned 138,074 acres. The fire was driven by high temperatures, high winds and low relative humidity. The fire was declared contained on July 1 and controlled on July 2. Land ownership affected by the fire includes approximately 78,732 acres of ALNWRC; 60,254 acres of Department of Energy (DOE) lands; 980 acres of Bureau of Land Management; 3,633 acres of State lands; and 20,285 acres of private lands.

Fire suppression actions included construction of 41miles of dozer line which varied from one to four blades wide. No hand line or safety zones were constructed. Backfiring occurred on approximately 9,698 acres, all on ALNWRC. Air support included use of helicopters for water drops and use of air tankers for fire retardent drops. Water was dipped out of the Yakima River near the community of Benton City. Although fire suppression records indicate that substantial amounts of fire retardant were deployed throughout the fire area, post fire reconnaissance observations indicated that none was dropped in the Yakima or Columbia Rivers, and only one drop occurred in a riparian area (Snively Spring). Most of the existing roads within the ALE were used by suppression forces. Some dozer blading and grading occurred which removed vegetation from the road beds, widened the roads slightly (0 to 4 feet) and/or piled a berm of vegetation and soils along the road edges.

Vegetation resources were impacted to varying degrees as burn severity varied across the landscape. The majority of the fire resulted in low burn severity (defines effects to soils and hydrologic function of the affected watersheds), with a few small areas of unburned mixed in (see Soil and Watershed Assessment, Appendix I).

The fire resulted in removal of all or part of the vegetation and duff across most of the burned area. The overall fire effect to vegetation included approximately 141,075 acres of 75 to 100 percent mortality of all vegetation, 3,713 acres of 50 to 75 percent mortality, 18,863 acres of 25 to 50 percent mortality and 233 acres with none to less than 25 percent mortality. 44 acres of riparian habitat were affected by the fire. Loss of vegetation in wet areas included mortality of an average of approximately 60 percent of all vegetation within the riparian zones (reference Vegetation Mortality Map, Appendix III). A detailed account of fire effects to the vegetative resources is documented in the 24 Command Fire BAER Vegetative Resources Assessment (Appendix IV).

Elevation within the fire area ranges from 500 to 3,500 feet. The climate of the Hanford Site is dry, with the 6 to 13 inches of precipitation falling in autumn and winter. Summers are hot and dry.

Plant communities within the fire area include primarily big sagebrush/blue bunch wheatgrass, three tip sagebrush/blue bunch wheatgrass, bitter brush/Indian ricegrass, and big sagebrush dune complex. Several springs and associated short stretches of desert streams occur in the fire area and provide year around water sources. Vegetation in the riparian areas includes black cottonwood, mock orange, choke cherry, squawberry, blue elderberry, serviceberry, wild rose, bull rushes, peach-leaf willow, and several species of shrub willows. The only perennial water course in the fire area is the Yakima River, with the Columbia River to the north and east sides of the fire boundary. Many ephemeral drainages occur throughout the fire area. The last major wildfire which burned through the 24 Command Fire area occurred in 1984. Many smaller fires have occurred since then, including the 1998 Yakima Ridge Fire.

The Hanford Site is located in the Pacific Flyway. Habitats within the fire area serve as resting areas for neotropical migratory birds. The Hanford site includes habitat for many wildlife species, including 40 mammals, 246 birds, 4 amphibians, 9 reptiles, 49 butterfly taxa, 318 species of moths, and 52 taxa of aquatic macro invertebrates. Species diversity on the Handford Site can be attributed to the size, diversity and relatively undisturbed condition of the native shrub-steppe habitat.

The portion of the Hanford Site that includes the north slope of Rattlesnake Mountain and lies south of State Highway 240 was actively used for ecological research by the Atomic Energy Commission (AEC) beginning in 1952. In 1967 the AEC designated the ecological

study area as the Arid Lands Ecology (ALE) Reserve. In 1972 the ALE Reserve was also formally designated as the Rattlesnake Hills Research Natural Area. In 1977 the Energy Research and Development Administration further designated all open lands of the Hanford Site, including the ALE Reserve, as the "Hanford National Environmental Research Park." Thus, much of the land area involved in the 24 Command Fire has a rich use history for ecological research, science training and education, and biodiversity protection through decades-long management as a Federal Research Natural Area.

The portion of the fire that occurred on DOE lands is administered as a former nuclear weapons production facility and radioactive waste disposal site.

The portion of the fire that occurred on the Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE) is part of a National Monument designated for the primary purpose of protecting and preserving all of the species associated with the shrub-steppe ecosystem. The objectives of the ALNWR include participation in the national effort to preserve adequate examples of all major ecosystems types or other outstanding physical or biological phenomena.

## B. Reconnaissance Methodology

Information used in this assessment is based on a review of relevant literature, agency management planning documents, agency wildlife sighting and habitat inventory data, communication with FWS and NMFS, personal communication with agency biologists (listed at end of report), and reconnaissance of the fire area on July 1 through 3, 2000. Reconnaissance included a helicopter flight over the fire area on July 2. Field notes were recorded on Incident Command System Unit Logs (ICS Form 214) and included in the BAER file provided to the two agency representatives. Burn severity was mapped by the BAER Watershed Team, and vegetation mortality was mapped by the BAER Vegetation and Wildlife Specialists. Habitat information and mapping for the various species is based on agency records and post fire reconnaissance. Reconnaissance and analysis included review of other fires in the area to assess effects to species and vegetative recovery.

## C. Findings

To better understand the species and habitat information discussed in this wildlife assessment, it is important to review the 24 Command Fire BAER Vegetation and Watershed Resource Assessments. These reports contain more detailed descriptions of pre-fire vegetation, post-fire vegetative recovery estimates, and effects to the watersheds.

The purpose of this assessment is to discuss the potential effects of the fire, suppression actions and proposed emergency rehabilitation activities to federally listed and sensitive species which occur within the fire area. Effects to general wildlife species are not discussed. This assessment is not intended to definitively answer the many questions of effects to specific species that are inevitably raised during an incident such as the 24 Command Fire. The focus of this assessment is to determine the potential for immediate, emergency actions that may be necessary to prevent further effects to these species. Because the species discussed in this assessment have ranges or territories which extend beyond the fire area, it may be important to include information at a larger scale, across land ownership boundaries, for species which may require assessment for long term rehabilitation or restoration needs. This assessment does not include analysis or discussion of potential effects that may have occurred to DOE facilities or potential contaminant release sites. DOE and PNNL personnel are currently assessing this

situation to determine potential effects from radioactive and chemical waste material to species and habitats occurring on DOE lands.

**BIOLOGICAL EVALUATION**

Direct effects as described in this report refer to mortality or disturbance that results in flushing, displacement, harassment or mortality of the animal. Indirect effects refer to modification of habitat and/or effects to prey species.

**SHRUB-STEPPE DEPENDENT WILDLIFE SPECIES**

The community of plants and animals found in this area represents the largest remaining example of the shrub-steppe ecosystem that once covered the Columbia River Basin. Termed a biological treasure, the monument contains rare, rich and diverse shrub steppe ecosystem flora and fauna that has been lost elsewhere due to habitat conversion, fragmentation and application of pesticides. The shrub-steppe ecosystem supports an unusually high diversity of native plant and animal species, including significant breeding populations of nearly all steppe and shrub-steppe dependent wildlife. This area serves a critical role in contributing to the local, regional, national and international ecological integrity of the shrub-steppe ecosystem. The area provides critical corridor links for shrub-steppe obligate species traveling between the Saddle Mountain National Wildlife Refuge Unit and the Yakima Training Range (YTR) habitat. These corridors represent some of the last remaining intact shrub-steppe communities in the Columbia Basin Ecoregion. Rehabilitation efforts are needed to maintain these corridors to facilitate movement of terrestrial wildlife. It is critical to the survival of the shrub steppe ecosystem to minimize fragmentation and loss of connectivity between these habitats.

While fire has played an integral role in the history of the shrub-steppe environment, the region's historical fire regime has been greatly altered from socio-political and economic factors. Coupled with the arrival of invasive species and noxious weeds, this has weakened the natural recovery processes of the shrub steppe ecosystem from disturbance events such as fire. The ALE provides rare and unique habitat that is critical for meeting FWS regional, national and ecosystem goals and objectives. Managing for biological integrity in this area necessitates that actions be taken to mitigate the ecological effects from years of fire suppression and invasion of exotic species.

The 24 Command Fire resulted in significant negative effects to this plant community through removal of approximately 85 percent of the sage brush and associated plants. The 69,244 acres of shrub-steppe plant community within the fire area represented approximately 10 percent of all shrub-steppe communities in the State of Washington. This area is considered to be the largest contiguous steppe area in the State. The sage brush is either a food source or provides nesting, resting, thermal and escape cover for a wide variety of species. Other value for wildlife includes the thick canopy which protects underscore vegetation that can be a valuable food source for wildlife. Wildlife species in the fire area that are dependent on the sagebrush shrub-steppe and have federal or state listing status include: Ferruginous hawk, burrowing owl, loggerhead shrike, sage sparrow, sage thrasher, western sage grouse, long-billed curlew, Merriam's shrew, pygmy rabbit, black tailed jack-rabbit, and striped whipsnake.

**FERRUGINOUS HAWK** (prepared by Heidi Brunkal)

Ferruginous hawks are migratory raptors that occur on the Hanford site during the breeding season from early March through July. The incubation period is 28-33 days with fledging at 44-48 days from the date the egg is laid. Ferruginous hawks are known to breed on the

Hanford site and on private land on the south slope of Rattlesnake mountain. There are 30 ferruginous hawk nests (16 nest sites) within Central Hanford, where they occupy power towers. There are 5 historical nests on the ALE Reserve (3 nest sites). Ferruginous hawks forage widely both on the site and in surrounding areas. In many areas the number of nesting pairs, number of eggs laid, and number of young fledged, vary in synchrony with small mammal abundance. Ferruginous hawks are listed as Threatened by the State of Washington and are considered a federal Species of Concern. Ferruginous hawks are sensitive to human presence, and will abandon their nests if subject to human encroachment. Activities (especially noisy ones) near nesting sites should be limited during the breeding and fledging season.

DIRECT EFFECTS: Ferruginous hawk were likely present during the fire. Twelve nest sites are located within the fire area. Adults and fledglings that were present during the fire are considered to be mobile and capable of escaping the affected area. Nest sites are located on electrical power towers at average heights of 20' to 40' and were probably not damaged by the fire. Young may have fledged prior to the fire. However, recent fledglings are capable of only short flights and perch on the ground until they gain flight capability. It is likely that fledglings from nests in the burn area perished in the fire.

INDIRECT EFFECTS: The entire area affected by the fire is considered foraging habitat for Ferruginous hawks. Effects on small mammal abundance and distribution due to the fire will effect the foraging efficiency of these birds. The loss of shrub cover due to the fire will probably initially improve the foraging success of raptors and other predators, because hiding cover for prey species has been eliminated. However, this initial affect will be short term. Over a longer term, any negative impact to small mammal abundance will decrease foraging opportunity for Ferruginous hawks. Newly fledged juvenile birds will probably experience the greatest impact from changes in prey availability. It takes 2 years for Ferruginous hawks to reach adult maturity, and juvenile survival rates are relatively low. Changes in abundance of jackrabbits due to impacts from the fire may impact the number of nesting pairs, number of eggs laid, and number of young fledged within the burn area. Although it is unknown at this time, it is thought that ferruginous hawks will not return to historically used nests until prey availability returns to pre-fire conditions.

POST-FIRE OBSERVATIONS: No Ferruginous hawks were observed during post fire reconnaissance. Nest locations were not specifically checked for presence or absence of individual birds. PNNL does have data on ferruginous hawk presence from June 2000 surveys.

**WESTERN BURROWING OWL** (Heidi Brunkal)
Burrowing owls are small ground-dwelling species associated with dry, open, shortgrass, treeless plains, often linked with burrowing mammals. Presence of nest burrows is a critical requirement for the Western burrowing owl. Foraging areas are typically short grass dominated habitats, food items include predominately invertebrates and small mammals, and occasionally small birds and reptiles. Within the Columbia Basin, Western burrowing owls are migratory and are present from February through early August. Breeding locations of Burrowing owls have confirmed within the fire area. The Western burrowing owl is thought to be declining throughout central Washington and much of its range in North America. It is also apparently declining at the Hanford Site. Once thought relatively common, they are now rarely observed. The regional decline of ground squirrels, which provide nesting sites for these owls, is possibly linked with the apparent decline in owl populations. The potential decline in population is not unique to Hanford and may be characteristic of the species population trend throughout eastern Washington.

DIRECT EFFECTS: Two known nest locations were within the burn area. During the fire any burrowing owls that were present were probably affected by the fire. Although burrowing owls are mobile and can fly, their habit is to run and/or hop along the ground. During the breeding cycle, the owls are tied to their nest burrow locations and retreat to the burrow for protection from avian predators. The burrowing owls that were present during the fire may have been killed due to this behavior. Seeking refuge within the burrow, may have killed owls through heat and/or asphyxiation by smoke. Juvenile owls, if present, would have been approximately 4 weeks old. At this stage, they are able to make short flights. However, fledging does not occur until 44 days after the eggs are laid. At this stage young can fly well, however, behaviorally they remain near the nest burrow and will retreat into the burrow at any sign of danger. It is likely that any young produced during this breeding season would have been at the burrow during the fire and would have most likely taken refuge within the burrow. The young would have experienced the same effects as the adult owls within the burrow during the fire.

INDIRECT EFFECTS: Approximately 110,611 acres of burrowing owl habitat was impacted by the fire. Impacts to invertebrate and small mammal populations will have long term effects upon Western burrowing owls. The elimination of shrubs effectively reduces almost all natural perch locations for burrowing owls. Further, elimination of shrub cover may expose small mammals to higher predation rates and consequently may reduce the local abundance of small mammals. Local population declines will impact burrowing owls in two ways; the number of available nest burrows will decline with associated decline in burrowing animals, and the prey availability will also decrease. A reduction of invertebrate prey, or changes in prey availability may impact the foraging efficiency of individual owls. Many dead invertebrates (beetles, grasshoppers, etc.) were observed during post-fire surveys at locations near nest burrows. The decline in prey availability has documented impacts on reproductive success. In one study, female owls that were artificially food supplemented laid more, larger eggs, and hatched more young than those not supplemented. Burrowing owls are also prey for other raptor species. Reduced plant biomass, and loss of cover could result in a higher predation rate on individual burrowing owls within the burn area. Additionally, burrowing owls are normally well camouflaged by their plumage, they now stand out dramatically against the blackened vegetation. This may also increase their vulnerability to predation. Shrubs are also important to burrowing owls as thermal cover, adults and juvenile owls seek thermal cover in the shade of shrubs during mid-day periods. Elimination of this thermal cover may increase the vulnerability of owls to stress related mortality. Finally, impacts to soil stability that may result from the fire may cause a higher probability of nest collapse, and potential nest locations may also become less abundant, if they collapse.

POST-FIRE OBSERVATIONS: Known burrow locations within the fire area were checked for presence of owls on July 4, 2000. One adult owl was present at one of the known burrows, no owls were present at the second burrow location. The interior of the burrows were scoped with a video surveillance system. The burrow where the adult owl was present had egg shell fragments within the burrow, but no juvenile owls were located. The other burrow had no evidence that it had been used for a nesting attempt during this breeding season.

**GOLDEN EAGLE**

Golden eagles have been observed in the fire area in the past and are considered to be a year round, uncommon species. No nests have been located.

DIRECT EFFECTS: If golden eagles were present during the fire, they would have been temporarily displaced due to the fire and suppression actions, including use of helicopters

and airplanes. If a nest occurred in the fire area, it may have burned and the occupants killed.

INDIRECT EFFECTS: Potential nest structures were probably unaffected by the fire (cliffs, large power poles). Prey species that were dependent on the shrub-steppe plant community were greatly reduced. However, remaining prey species will have less vegetation to use for hiding cover, therefore hunting for prey items may be easier for golden eagles. Carrion may be more available in the short term.

POST FIRE OBSERVATIONS: No golden eagles or potential nest sites were observed during post fire reconnaissance.

**LOGGERHEAD SHRIKE** (Heidi Brunkal)
The loggerhead shrike is a migratory passerine bird species that breeds in the Columbia Basin. Loggerhead shrikes frequent open habitats with short vegetation, interspersed with perch sites. Shrikes are predatory birds, and often "impale" their prey on spines or branches of plants, or on man-made structures such as fence posts or barbed wire. Preferred prey include arthropods, amphibians, small to medium sized reptiles, small mammals, and birds. Loggerhead shrikes are common on the Hanford site from early March until the end of August. After August numbers are reduced but individuals have been sited through early November. Loggerhead shrike nests are usually well hidden within trees and shrubs, averaging 0.8-1.3 meters off of the ground. Loggerhead shrikes are confirmed breeders on the site. They breed widely within the sagebrush flats of Central Hanford and in remaining big sagebrush on the ALE Reserve. They also utilize mixed sagebrush-bitter brush in dune environments. Individuals are highly territorial and exhibit site fidelity to nesting territories. This species is considered a shrub-steppe obligate and is a Washington State Candidate and federal Species of Concern.

DIRECT EFFECTS: Loggerhead shrikes are mobile animals. It is anticipated that any adult birds that were in the area of the fire were able to move away from flames and probably were able to leave the affected area. However, due to their strong behavioral site tenacity, individual birds probably attempted to return to their territories following the fire. Juvenile shrikes exhibit predator avoidance by attempting to seek cover. If juvenile shrikes were present they probably attempted to find hiding cover within brush or trees. Juveniles may have been killed during the fire due to this behavioral characteristic.

INDIRECT EFFECTS: A total of approximately 55,449 acres of suitable sagebrush and bitter brush habitat was affected by the fire with approximately 75% loss of shrub plants overall. Shrikes require shrubs and riparian trees for both nesting and foraging. Many prey items are "impaled" by shrikes on trees and shrubs. Loss of shrubs will effect foraging efficiency, because there are fewer areas and sites for prey to be impaled. The elimination of shrub cover will have dramatic effects on the nesting habitat for shrikes within the burn area. Average territory sizes (information from California and Idaho) are 20.7-21.9 acres. Because shrikes exhibit fidelity to nesting territories, individuals that attempt to return to former territories in subsequent breeding seasons will find them void of nesting cover and structure. Additionally, displacement of individual breeding pairs into other areas may increase inter- and intraspecific competition for nesting territories. If suitable habitat areas were already occupied by breeding pairs, displaced pairs may not be able to locate territories, or will be forced to utilize marginal habitat types. Breeding success would likely decline for pairs that have been displaced by fire impacts to their breeding habitat.

POST FIRE OBSERVATIONS: Loggerhead shrikes were observed during post fire reconnaissance. Individual birds were observed perched on the power line near gate 118,

near the junction of 1200 Foot Road and Benson Ranch Road on remaining sage, and flying along the Army Loop Road on Central Hanford. The observed individuals were apparently attempting to forage along edges of the burned area, or near small patches of unburned vegetation.

**SAGE SPARROW** (Heidi Brunkal)
The Sage sparrow is a migratory sparrow present in the Columbia Basin during the breeding season from early February until the end of September. Sage sparrows prefer semi-open habitat with evenly spaced shrubs 1-2 meters high. This species is associated with sagebrush throughout its range. Sage sparrows forage on the ground for seeds and invertebrates. On the Hanford Site, sage sparrows are abundant in areas that retain big sagebrush communities. The Hanford Site, along with the Yakima Training Center to the west, support the largest contiguous habitat patches in Washington for this state Candidate species. Exceptional habitats with apparent high densities of Sage Sparrows are found in big sagebrush stands along the base of the Saddle Mountains, throughout sagebrush habitats on the Columbia River plains, within Central Hanford, and on the ALE Reserve. Sage sparrows are confirmed breeders on the site, and they frequently raise more than one brood per season. They are territorial and exhibit site fidelity to nesting territories. Flocks of juveniles are frequently observed along roadsides from late May throughout the beginning of August.

DIRECT EFFECTS: Adult sage sparrows had probably initiated their third nesting effort, these nests were probably destroyed by the fire. Although sage sparrows are mobile animals, their individual behavioral site fidelity to their nesting territories may have increased their susceptibility to direct loss during the fire. Large flocks of juvenile sage sparrows had recently been observed on ALE reserve. These recently fledged birds may have been displaced due to the fire.

INDIRECT EFFECTS: Approximately 53,713 acres of big sagebrush vegetation within the burn area experienced mortality of 80 to 100 percent of the sagebrush plants. Therefore, all of the available sage sparrow habitat in the fire area was lost due to the fire. Due to the loss of shrub cover, adult birds with established territories probably returned to a highly altered habitat condition. These birds were probably displaced due to the fire. Because sage sparrows exhibit fidelity to nesting territories, individuals that attempt to return to former territories in subsequent breeding seasons will find them void of nesting cover and structure. Additionally, displacement of individual breeding pairs into other areas may increase inter- and intraspecific competition for nesting territories. If suitable habitat areas were already occupied by breeding pairs, displaced pairs may not be able to locate territories, or will be forced to utilize marginal habitat types. Breeding success would likely decline for pairs that have been displaced by impacts to their breeding habitat from the fire. Because sage sparrows require open areas and bare ground for foraging, changes in vegetation structure and loss of sagebrush due to the fire will impact foraging by sage sparrows. Sage sparrows abandon former habitats once they become invaded by cheatgrass. Thus, replacement of native vegetation by cheatgrass in areas disturbed by the fire will decrease the available habitat for sage sparrows.

POST FIRE OBSERVATIONS: Only one sage sparrow was observed during post fire reconnaissance of the area. This was a dramatic decline from pre-fire observations made this year. Sightings during June (2 site visits) averaged 22.5 sage sparrows detected per visit within the fire area.

**SAGE THRASHER** (Heidi Brunkal)
Sage thrashers are a migratory species present on ALE in low numbers from early April through September (breeding unconfirmed). The Washington State Candidate Sage

Thrasher is found at Hanford primarily in higher elevation habitats on the ALE Reserve in remnant patches of big sagebrush and three-tip sagebrush. They are essentially absent from the lower elevation Central Hanford.

DIRECT EFFECTS: Sage thrashers are mobile animals and would have been able to move out of the fire area. The majority of the known locations of sage thrasher within the burn area are in the three-tip sage zone at higher elevations. These areas were near the western edge of the burn and it is likely that sage thrashers could have found refugia adjacent to the affected area. Therefore there may have been no direct effects to sage thrashers.

INDIRECT EFFECTS: A total of 10,382 acres of three-tip sage brush habitat within the burned area experienced an mortality of 80 to 100 percent of the sage brush plants. The elimination of three-tip sagebrush at higher elevations of the fire area will have long term impacts for sage thrashers. All available habitat, mature three-tip sage brush, was impacted by the fire. Long term effects would include displacement of sage thrashers from the burn area. It is anticipated that this species will not return until the three-tip sagebrush recovers to maturity and provides the necessary habitat structure to support sage thrashers. It is unknown if potential re-colonizing populations exist nearby

POST-FIRE OBSERVATIONS: No sage thrashers were detected during post fire reconnaissance.

**WESTERN SAGE GROUSE** (Larry Cadwell)
Western sage grouse listed as Washington State threatened and a federal species of concern. Two small, disjunct remnant populations of sage grouse occur in Washington State. One population is in Douglas County approximately 75 miles north of Hanford, and the second is on the Army's Yakima Training Center (YTC) in Yakima and Kittitas Counties just north of the Hanford Site. The Douglas County population is estimated at 600 - 700 birds and the YTC population at 300 - 400 birds. As recently as 1999 the YTC population appears to have begun to expand into that portion of the monument included in the ALE Unit. Several sage grouse sightings were made in 1999 and 2000 in the vicinity of Rattlesnake Springs and Benson Ranch.

Western sage grouse nesting habitat in southeastern Washington is primarily sagebrush-steppe vegetation that is of relatively high quality (dominated by native species). Sagebrush intermixed with tall bunch grasses provides cover required for successful nesting. Brood rearing habitat includes the shrubs and tall grasses for escape cover, but also must include a mix of native forbs that provide both insects and high protein vegetation. Sage brush is an essential element for sage grouse during the late fall, winter and early spring, when the leaves of sage make up as much as 99% of the birds diet.

An interagency working group was established in 1998 to assist with the recovery of the sage grouse in Washington. Several agencies (U.S. Army, U.S. Fish and Wildlife Service, the Washington Department of Fish and Wildlife and the Department of Energy and the Yakama Nation) are working to preserve and restore sage grouse in eastern Washington State. It is noteworthy that the Hanford Site property (ALE Unit) was identified as one of the few large land areas having contiguous and high quality habitat suitable for sage grouse recovery and expansion. The recent 1999/2000 sighting confirmed that observation and provided optimism that ALE Unit lands would provide for expansion of the YTC breeding population. Prior to the 24 Command fire, sage grouse habitat on ALE provided probably the single best hope for expansion of the YTC breeding population. The Nature

Conservancy concluded in their “Biodiversity Inventory and Analysis of the Hanford site” that “successful re-establishment of the Washington State Threatened Western Sage Grouse on the Hanford Site will depend on maintaining or developing extensive stands of mature big sagebrush / bunchgrass communities in proximity to riparian areas and open grasslands.”

DIRECT EFFECTS include mortality of both adults and young that were unable to escape the flames. The fire occurred during the brood rearing season. Young chicks were out of the nest but unable to move quickly or to move great distances from the nest. Any animals that did escape the fire would have experience stress from that flight. The 24 Command Fire approached and burned through the area with recent sage grouse sightings from the north and west, which would have cut off the most likely escape corridor leading back toward the YTC.

INDIRECT EFFECTS include loss of habitat (nesting habitat, winter and summer shelter habitat, escape cover losses and food resources lost). Sage grouse on ALE at the time of the 24 Command Fire would likely have been forced to flee to the south and east, where there is little or no suitable habitat. Lands to the south and east include agricultural lands and lower elevation lands in central Hanford, which were extensively burned in 1984 and are unlikely to contain sufficient habitat to sustain sage grouse. In addition, the forbs and invertebrates which are the preferred food for this species were effectively eliminated throughout most of the fire area.

Regionally, the loss of 64,095 acres of sagebrush habitat represents a significant decrease of suitable habitat for this species. This habitat loss may delay or prohibit recovery of the western sage grouse in the State of Washington.

Due to the significant amount of habitat lost, and because any remaining sagebrush does not occur in the large blocks apparently needed for survival, it is expected that this area will not support sage grouse for 30 or more years. The arid nature of the site may further delay recovery because germination and growth of shrub species depends upon amount and timing of available moisture.

POST FIRE OBSERVATIONS: No sage grouse were observed during post fire reconnaissance.

**LONG-BILLED CURLEW**

Long-billed curlews are known to nest within the fire area. They select sparse, mixed stands of bluegrass and cheatgrass, or pure cheatgrass, for nesting. Such stands occur in places where fire or other disturbance previously destroyed the shrubs.

DIRECT EFFECTS: If long-billed curlew occurred within the fire area, they may have experienced displacement. It is expected that adults could have flown out of the fire area. However, young birds, if still in the nest or in early stages of fledging, would not have been able to escape effects of the fire. From recent surveys within the fire area, it is known that the young are very small and have just fledged from the nests. It appears that this years young would not have survived this incident.

INDIRECT EFFECTS: Because this species nests in grasses, the current year nesting habitat within the fire area was removed. In subsequent years, because grasses will return as early seral species in areas where brush was removed, potential breeding habitat may be increased. Prey species were decreased by the fire. However, this decrease in insects should be only temporary. Prey abundance should be approximately the same as before the fire by the time the next breeding season occurs. However, the types of insects, and species diversity, may change.

POST FIRE OBSERVATIONS: No long-billed curlews were observed during post fire reconnaissance.

**MERRIAM'S SHREW**

Merriam's shrew prefers dry habitats and is generally found in sagebrush and grasslands of Western North America. On the Hanford site, this species has been documented to occur in association with three-tip sage brush at the higher elevations on the ALE. The Merriam's shrew uses burrows created by the sagebrush vole and other burrowing mammals. The diet of this shrew includes caterpillars, beetles, crickets and wasps. Shrews have exceedingly high metabolism and must feed frequently both day and night. Shrews are generally solitary except for short periods during the breeding season (spring). Shrews are preyed upon by owls, snakes and some mammals.

DIRECT IMPACTS: The Merriam's shrew was probably present within the affected area during the fire. Because of it's subterranean habit, it may have been protected by being under ground during the fire. Alternatively, this animal may have been killed through heat and/or asphyxiation by smoke.

INDIRECT IMPACTS: Due to the direct impact to invertebrate prey within the burn area, prey availability for shrews was probably dramatically decreased. Because of the metabolic needs of the Merriam's shrew, and it's requirement to forage nearly constantly, it is possible that many of these animals died shortly after the fire due to a lack of prey to meet energetic demands. Insects found within the ground would still be readily available, and insects above ground will quickly repopulate the fire area. However, the species abundance and diversity may have changed from pre-fire conditions.

POST FIRE OBSERVATIONS: No shrews were seen during post fire reconnaissance. However, a the observed loss of three-tip sage brush habitat indicates that the shrew population in the area probably was affected by the fire impact.

**PYGMY RABBIT**

This species is extremely rare in Washington, occurring only in the Great Basin portion of the Lower Columbia Basin. The pygmy rabbit is limited to habitat types which contain tall dense sagebrush. Field observations of the pygmy rabbit indicate heavy reliance on sagebrush, primarily the seed heads and vegetative leaders. Pygmy rabbit diet is comprised of 99% sagebrush in winter and 51% in summer. A pygmy rabbit colony was last observed on the Hanford Site in 1984 before a large fire burned off much of the sagebrush on the Site. Prior to that event, a small population was located on Rattlesnake Mountain, above Snively Springs. Subsequent to 1984, surveys for small mammals have resulted in no observations of pygmy rabbits.

DIRECT EFFECTS: If pygmy rabbits were present during the fire, they may have been temporarily displaced. Because the fire was mainly wind driven, rabbits that could not out run the fire may have been overcome if unable to find shelter in burrows.

INDIRECT EFFECTS: Field observations of the pygmy rabbit indicate heavy reliance on sagebrush, primarily the seed heads and vegetative leaders. Pygmy rabbit diet is comprised of 99% sagebrush in winter and 51% in summer. The pygmy rabbit is limited to habitat types which contain tall dense sagebrush.

POST FIRE OBSERVATIONS: No pygmy rabbits were observed during post fire reconnaissance. Observations included fire scars to plants, rocks and soils which indicate how the fire moved through areas at a high rate of speed. Consumption of the

majority of the sagebrush, with few remaining islands which might have provided refuge during the fire and will now provide the only remaining habitat until the sagebrush returns.

**BLACK-TAILED JACK RABBIT** (Heidi Brunkal)
The black-tailed jackrabbit was once abundant throughout the Columbia Basin. Recent precipitous declines in populations if these hares have raised concerns regarding its distribution and status throughout the region. This species is closely associated with the sage brush steppe ecosystem. Black-tailed jackrabbits rely on sage brush structure for breeding sites and hiding cover, and require sage-brush vegetation as forage during winter months. Hares, unlike rabbits, do not use burrows. They place their young in shallow depressions in the soil called "forms". Jackrabbits are generally solitary and primarily nocturnal. They are vulnerable to predators including, coyotes, bobcats, foxes, hawks, owls, and snakes. Loss of habitat due to agricultural and human development has impacted jackrabbit populations. The fragmentation and isolation of populations residing within remnant habitat areas, has probably increased their vulnerability to stochastic events (e.g. severe weather, disease, fire, etc.) and has limited the re-colonization of areas that could potentially support jackrabbit populations.

DIRECT EFFECTS: Black-tailed jackrabbits are known to be relatively fast moving animals. Because these animals are highly mobile, it is anticipated that they would have been able to move out of the way of the fire. Young rabbits, however, if present may have been overwhelmed by the fast moving fire.

INDIRECT EFFECTS: The loss of sage brush structure and cover reduces the amount of hiding cover for this species, and will increase the vulnerability of jackrabbits to predation. Additionally, the loss of a significant continuous stands of sage exacerbates this effect, because smaller patches do not provide escape cover. If jackrabbits are chased out of the remaining small patches of cover, they will be forced into the open burned over areas and be easily captured and consumed. Impacts to the local jackrabbit population will also affect those animals that prey on jackrabbits, as jackrabbit numbers decrease, there will be less forage for other animals that prey upon jackrabbits.

POST-FIRE OBSERVATIONS: Two black-tailed jackrabbits were observed during post fire reconnaissance. These animals were located near a small patch of remaining unburned sage brush. It appeared that these individuals were seeking cover within the unburned portions of the fire area.

**ELK** (Heidi Brunkal)
Elk first appeared naturally on the ALE in 1972. Those using the ALE are a part of a larger population referred to as the Yakima Herd which populates the Rattlesnake Hills from the ALE west to Yakima. Although elk are not traditionally found in sage brush steppe habitats, zooarchaeological evidence suggests elk historically inhabited the arid Columbia Basin, but were hunted to extinction by 1850. The Rattlesnake hills elk have shown a consistently high level of productivity over the 17 years that data has been collected. The average calf/adult cow ratio over the period of measurement was 58/100. The long term (1983-1993) growth trend for the Hanford elk herd averages a 20% increase annually, indicating that the sage brush steppe ecosystem is excellent habitat for elk. The herd is attracted to ALE by high quality habitat and a lack of disturbance. Hunting has not been allowed on ALE, and there is only limited public use, mostly research activities. As a result, when hunting begins outside ALE, all of the elk in the area move into the sanctuary provided by ALE. In 1998 the estimated calf production of approximately 150 brought ALE elk numbers to about 750. The increasing herd size has increased local concern regarding elk depredation of agricultural crops in areas surrounding ALE. During the winter of 1999/2000, 175 elk were removed from the herd and relocated to other areas within the

state. The population at the time of the fire was assumed to be approximately 575 adult animals with the potential of 130 calves present. The elk distribution during early summer has traditionally been in the higher elevation areas of ALE. The elk were using these upper elevation areas for calving during the two to three weeks prior to the fire.

DIRECT EFFECTS: Elk are highly mobile animals, and it is anticipated that they were able to move out of the affected area during the fire. Recently born calves, however, may not have been able to move out of the way of the fire, although no mortality of elk calves was documented following the fire.

INDIRECT EFFECTS: The greatest impact to elk within the burn area is loss of available forage. Due to the timing of the fire, it is not anticipated that any appreciable rain fall, and therefore any regrowth of grasses, will occur over the next 5 months (November). Impacts of the elimination of above ground forage species within the burn area may be two fold; 1) Elk will forage off of the burn area on private lands. This will continue to exacerbate the problem of depredation of agricultural crops (wheat, alfalfa, orchards and vineyards); 2) Elk may experience nutritional stress related to the decrease in forage availability. Lactating cows may be at the greatest risk of this type of stress because of the energy demands that lactation produces. Additional indirect impacts to the elk include exposure to collisions with vehicle traffic within and adjacent to the fire area. As the elk move into different areas seeking forage, they are likely to cross Highway's 240, 225, 24 and 221.

An additional indirect effect may be that if elk continue to remain on private lands during the late summer and fall seasons, this herd will experience greater vulnerability to hunting pressure during the upcoming hunting season. Private lands surrounding the ALE area are open to elk hunting. If elk move into Central Hanford, they will be a cause of concern for Hanford facilities operations, particularly if they move onto the BC-Cribs radiation control zone.

POST FIRE OBSERVATIONS: During post fire reconnaissance, elk were observed within and adjacent to riparian areas (Upper Snively). Young elk still had spots, indicating they are less than 4 weeks old. Two bull elk were struck and killed on Highway 240 southeast of the burn area during the early morning of July 4, 2000.

**MULE DEER** (Heidi Brunkal)
Mule deer are a common resident ungulate of the Hanford area. The areas of highest density are on the ALE and along the Columbia River. The deer population in the Hanford area is relatively stable. Deer frequently move offsite and are killed by hunters on adjacent public and private lands. Mule deer are primarily browsers and rely on riparian vegetation and bitter brush for browse. Hunting has not been allowed on any Hanford lands exclusive of the former Waluke slope wildlife recreation area north of the Columbia River, and there is only limited public use consisting primarily of research activities. Many of the mule deer on the ALE and Central Hanford reach unusual size, with many animals in older age classes due to the sanctuary that the area provides.

DIRECT IMPACTS: Mule deer are highly mobile animals, and it is anticipated that they were able to move out of the affected area during the fire. Recently born fawns, however, may not have been able to move out of the way of the fire, although no mortality of deer fawns was documented during post fire reconnaissance.

INDIRECT IMPACTS: The greatest impact to mule deer within the burn area is loss of available forage. Many of the riparian areas and springs were impacted by the fire.

Estimated losses within riparian vegetation are 80-100%. Because of available water, these areas may recover some of their vegetation over the next several months. A large portion of bitter brush (1,437 acres) was also lost within the burn area, which decreases the available browse for deer. Regrowth of grasses in upland areas is not anticipated until fall rains begin, possibly in November. Mule deer will forage off of the burn area on private lands, however, because deer are more solitary than herding ungulates (elk) agricultural depredation is not an issue with deer. However, vulnerability to hunting mortality will be increased if deer remain off of the burn area into the late summer and fall hunting season. Private lands adjacent to the burn area are open to hunting. Additionally, deer may also experience some nutritional stress due to loss of forage during the fire. Lactating does may be at the greatest risk of this type of stress because of the energy demands that lactation produces.

POST FIRE OBSERVATIONS: Deer were observed throughout the fire area during the aerial and ground post fire reconnaissance.

**STRIPED WHIPSNAKE**

Striped whipsnakes occur in the Columbia Basin of Central Washington up to 1,985 feet elevation. It is rare throughout most of the Washington portion of its range. Habitat for this species is low elevation arid regions with scattered vegetation and open rocky areas. Mating occurs in the spring with eggs being deposited in June. Eggs hatch in the late summer or early fall. This species has been documented to occur at the Hanford site.

DIRECT EFFECTS: If present during the fire, striped whipsnakes could have experienced mortality if unable to move quickly or find a burrow. Those that survived would experience temporary displacement. Eggs exposed to heat would have been rendered unviable. Suppression actions which included blading of soils to remove vegetation may have exposed nest sites, thus exposing eggs to environmental conditions and predators.

INDIRECT EFFECTS: Prey species are primarily lizards, but may include rodents, bats, frogs, birds and other snakes. Habitat for any of these types of species within the fire area was greatly reduced. Therefore, prey species may be less available for the striped whipsnake until the habitat recovers and is repopulated by the various prey species.

POST FIRE OBSERVATIONS: No snakes were observed during post fire reconnaissance.

**HABITAT IMPROVEMENTS WITHIN THE FIRE AREA**

There were no structural improvements for wildlife within the fire area. Several research and monitoring sites were burned through. Other habitat improvements within the fire area, including sage brush plantings located approximately in the middle of the ALE portion of the burned area. Plantings occurred in November 1998: Approximately 75,000 sagebrush in 25 plots covering about 200 acres; and December, 1999: Approximately 51,000 sagebrush across about 130 acres.

Springs within the fire area were not developed for wildlife use.

**24 Command Fire Species List**

On July 3, 2000, current species lists for the 24 Command Fire area were obtained from U. S. Fish and Wildlife, U. S. National Marine Fisheries Service, and the Washington Department of Fish and Wildlife. In addition, the species list from the *Final Hanford Comprehensive Land-Use Plan environmental Impact Statement* (1999) was reviewed.

On June 9, 2000, President Clinton directed the FWS to manage the Hanford Reach National Monument to protect all of the species associated with the shrub-steppe ecosystem. The Department of Energy is directed to, "Preserve sensitive habitat and species identified through monitoring efforts." This includes species with federal, state or agency listed status or species of concern (Arid Lands Ecology Facility Management Plan, 1993). Included in the Memorandum of Understanding between FWS and DOE for management of ALE is, "The primary objective of the FWS is to ensure that the ALE is operated and managed for the protection and preservation of the native shrub-steppe habitat and its associated wildlife species." The federal agencies are also charged with managing for species of importance to the Tribes. Consultation with the Tribal representatives occurred between July 2 and July 6, 2000. Therefore, the following species are included in this assessment from the Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement (1999), and the State of Washington Department of Fish and Wildlife species list. This list was developed by Jeffrey Hass, Heidi Brunkal, Dana Ward, and Larry Cadwell.

| SPECIES | LISTING STATUS |
|---|---|
| Ferruginous hawk, *Buteo regalis* | FSC/ST |
| Burrowing owl, *Athene cunicularia* | FSC/SC |
| Golden eagle, *Aquila chrysaetos* | SC |
| Loggerhead shrike, *Lanius ludovicianus* | FSC/SC |
| Sage sparrow, *Amphispiza belli* | SC |
| Sage thrasher, *Oreoscoptes montanus* | SC |
| Western sage grouse, *Centrocercus urophasianus* | ST |
| Long-billed curlew, *Numenius americanus* | SM |
| Merriam's shrew, *Sorex merriami* | SC |
| Pygmy rabbit, *Brachylagus idahoensis* | FSC/SE |
| Black-tailed jackrabbit, *Lepus californicus* | SC |
| Elk, *Cervus elaphus* | TI |
| Mule deer, *Odocoileus hemionus* | TI |
| Striped whipsnake, *Masticophis taeniatus* | SC |

The following listed species were identified as occurring, or having habitat within, Benton County. Through post fire reconnaissance and consultation with local experts, it was determined that these species were not affected by the fire because they have no habitat within or adjacent to the fire area, and/or inventories prior to the fire determined absence, outside of range, or not expected to be affected by potential post-fire flooding:

| | |
|---|---|
| Bald eagle, *Haliaeetus leucocephalus* (no habitat within fire area) | T/ST |
| Aleutian Canada goose, *Branta canadensis leucopareia* (no habitat within fire area) | T/ST |
| American white pelican, *Pelacanus erythrorhynchos* (no habitat within fire area) | SE |
| Peregrine falcon, *Falco peregrinus* (no habitat within fire area; migratory) | FSC/SE |
| Sandhill crane, *Grus canadensis* (no habitat within fire area; migratory) | SE |
| Common loon, *Gavia immer* (no habitat within fire area) | SS |
| Flammulated owl, *Otus flammeolus* (no habitat within fire area) | SC |
| Lewis' woodpecker, *Melanerpes lewis* (no habitat within fire area; transitory) | SC |
| Northern goshawk, *Accipiter gentilis* (no habitat within fire area; transitory) | SC |
| Great blue heron, *Ardea herodias* (no habitat within fire area) | TI |
| Pacific (Townsend's) western big-eared bat, *Corynorhinus townsendii* (no habitat within fire area) | SC |
| Washington ground squirrel, *Spermophilus washingtoni* (no habitat within fire area) | SC |
| Bull trout, *Salvelinus confluentus* (extirpated from area below fire) | T |
| Upper Columbia River Spring Chinook Salmon, Onchorynchus tshawytscha | |

| | |
|---|---|
| (habitat in Columbia River is above confluence with Yakima River) | E |
| Middle Columbia River Steelhead, *Onchorynchus mykiss* (habitat in Columbia River is above confluence with Yakima River) | T |
| Upper Columbia River Steelhead, *Onchorynchus mykiss* (habitat in Columbia river is above confluence with Yakima River) | T |
| Columbia pebble snail, *Fluminicola columbiana* (outside of fire affects area) | C |
| Shortfaced lanx, *Fisherola nuttalii* (outside of fire affects area) | C |
| Columbia river tiger beetle, *Cicindela columbica* (no habitat within fire area) | SC |
| Juniper hairstreak, *Mitoura siva* (no habitat within fire area) | SC |
| Silver-bordered bog fritillary, *Boloria selene atrocastalis* (no habitat within fire area) | SC |

KEY TO LISTING STATUS:

| | |
|---|---|
| E | FEDERAL ENDANGERED |
| T | FEDERAL THREATENED |
| FSC | FEDERAL SPECIES OF CONCERN |
| SC | STATE CANDIDATE |
| SE | STATE ENDANGERED |
| ST | STATE THREATENED |
| SS | STATE SENSITIVE |
| SM | STATE MONITOR |
| TI | TRIBAL IMPORTANCE |

## IV. RECOMMENDATIONS

### A. Management

**1.** Determinations of effect: The fire, suppression actions and proposed emergency rehabilitation had no affect to the federally listed species: Bald eagle, Aleutian Canada goose, bull trout, Upper Columbia River spring Chinook salmon, and Middle Columbia River steelhead. These determinations were discussed with, and agreed to by Heidi Brunkal, Jeffrey Haas and Dale Bambrick of FWS, and David Geist and Larry Cadwell of PNNL. Therefore there is no need for emergency Section 7 Consultation for the 24 Command Fire and emergency rehabilitation.

**2.** Recommendations with Specifications (see Part F of BAER Report):

- **!** Any determinations documented in this assessment should be reevaluated, and emergency Section 7 Consultation conducted as needed, if additional rehabilitation measures or vegetation management activities are proposed after July 7, 2000. If non-emergency management activities are proposed, another Biological Assessment should be prepared. All non-specification management recommendations made in the 24 Command Fire BAER Report have not been assessed for effects to federally listed species.

- **!** Monitoring (specifications included in Section F of this BAER report)

1. DETERMINE FIRE EFFECTS TO SHRUB-STEPPE DEPENDENT BIRD SPECIES N-1b Protection of T&E Species: Birds (listed). Monitor fire effects to Agency listed species: ferruginous hawk, burrowing owl, loggerhead shrike, sage sparrow, sage thrasher, western sage grouse and long-billed curlew by determining post fire presence, reproductive status and

reproductive success. Monitoring design, purpose and need are discussed in detail in the Specification form.

2. DETERMINE FIRE EFFECTS AND POST FIRE MOVEMENT OF ELK S-1d Public Safety: Elk Monitoring. Monitor locations and movement patterns of elk to determine habitat use within and adjacent to the fire area, and locations of road crossings. Monitoring design, purpose and need are discussed in detail in the Specification form.

3. PUBLIC SAFETY ROAD SIGNS S-2b Safety Signs - Elk. Warning signs should be installed along Hwy 225 and 240 where there is the potential for elk to cross. Sign design and location, purpose and need are discussed in detail in the Specification form.

If the need is identified, conduct an assessment of effects to species of Tribal importance not addressed in this report. No specification prepared at this time.

**3.** Management recommendations that are beyond the scope of BAER (no Specifications):

- **!** Existing wildlife related research and monitoring plots should be reestablished to continue ongoing studies and to obtain new information on fire effects to various species and their habitats.

- **!** This fire provides an excellent opportunity for research on fire effects to shrub-steppe dependent species. It is especially important to research management tools for how to provide climax habitat for these species given the vulnerability of this ecosystem to wildfire.

- **!** Permanent photo points and monitoring plots should be established in key wildlife habitat locations to monitor habitat recovery. This should be coordinated with the vegetation monitoring as recommended in the 24 Command BAER Vegetation Report.

- **!** Small mammal monitoring should be conducted using existing trapping grids and should be expanded as needed to determine prey species abundance for the various fire affected species.

- **!** Reptile and amphibian monitoring should be conducted using existing trapping locations and should be expanded as needed to determine potential effects of the fire and associated habitat loss.

## V. CONSULTATIONS

| | |
|---|---|
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| | |
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*People who reviewed the draft BAER Wildlife Resource Assessment.

## VI. REFERENCES


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Washington Department of Fish and Wildlife State listed species 6/21/2000

THE FOLLOWING SUPPORTING DOCUMENTATION CAN BE FOUND IN THIS BAER REPORT UNDER APPENDIX V:

U. S. Fish and Wildlife Service Species list dated 7/3/2000
U. S. National Marine Fisheries Service list dated 5/6/99
Washington Department of Fish and Wildlife State Listed Species dated 6/21/00
WDFW Priority Species: Vulnerable Aggregations and Species of Recreation, Commercial, and/or Tribal
Importance dated 8/31/98
Wildlife Species of Concern Occurring on the Hanford Site (from Final Hanford Comprehensive Land-
Use Plan Environmental Impact Statement, 9/99)

Specifications (Part F)

Other supporting documentation not included in this BAER report is filed in the 24 Command BAER file, including:

ICS 214 Unit logs
Species maps

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PREPARED BY:
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Notes and species writeups from Heidi Brunkal and Larry Cadwell

**U. S. DEPARTMENT OF THE INTERIOR**
**BURNED AREA EMERGENCY REHABILITATION TEAM**

**24 Command Fire**

**SOIL AND WATERSHED RESOURCE ASSESSMENT**

## I. OBJECTIVES

- Assess overall watershed changes from the fire, particularly those that pose substantial threats to human life, property, and critical natural and cultural resources. This includes evaluating changes to soil conditions, hydrologic function, and watershed response to precipitation events and high winds.
- Identify the most critical soil and watershed areas and issues related to the 24 Command Fire based on increased flood potential and loss of soil resources from water and wind, and prescribe treatments to mitigate impacts and risks.
- Develop a map of burn severity.
- Identify future monitoring needs.

## II. ISSUES

- Threats to human life and property in and adjacent to the burned area from wind-blown dust.
- Loss of ash, soil and nutrients due to wind erosion that could degrade site productivity.
- Threats to water quality of springs.

## III. OBSERVATIONS

### A. Background

**Geology/Physiography:** The 24 Command Fire occurred within the semi-arid Pasco Basin of the Columbia Plateau on the northeastern flank of Rattlesnake Mountain and part of the southwestern flank near the east end. Elevations of the burn area range from approximately 450 feet (137 m) above mean sea level (amsl) along the Yakima River to 3581 feet (1091 m) amsl atop Rattlesnake Mountain. All burned watersheds drain either southwest toward the Yakima River or northeast to the Cold Creek Valley. The upper northeast-facing portion of Rattlesnake Mountain is steep, with slopes up to 60%.

Rattlesnake Mountain above approximately 2000 feet amsl is underlain by the Miocene Columbia River Basalt which is composed of a multitude of basalt flows interbedded with fluvial and lacustrine sediments consisting of mud, sand, and gravel deposited between volcanic eruptions. These sedimentary interbeds are collectively called the Ellensburg Formation. The Pleistocene Hanford formation underlies much of the lower portions of the northeast flank of Rattlesnake Mountain below approximately 1000 feet amsl and consists of deposits from a series of cataclysmic floods. These floods occurred when ice dams broke releasing water from glacial Lake Missoula. Two facies are recognized, the Pasco gravels and the Touchet Beds (Kasper and Glantz, 1987). The Pasco gravels consist of coarser sands and gravels that were deposited in high-energy environments of rapid currents. The Touchet Beds consist of finer sands and silts that represent a low-energy (slack water) environment found on the basin margins and the flanks of the surrounding ridges. Holocene surficial deposits consisting of silt and sand form a thin veneer (less than five meters) across much of Cold Creek Valley. These deposits consist dominantly of

laterally discontinuous sheets of wind-blown silt and fine-grained sand. Surficial geologic units in the area are shown on a map and described in a report by Hartman (2000).

**Soils:** Hajak (1966) describes 15 different soil types on the Hanford Site. Of these, 12 occur within the burned area. Table 1 shows the extent of soils occurring within the burned portion of the Hanford Site. Approximately 24,000 acres of the burned area occurred in areas not covered by this survey. A soil map is included in Appendix III.

**Table 1.** Soil types occurring within the 24 Command Fire burned area.

| Soil Name | Acres | % of Burn |
|---|---|---|
| Burbank Loamy Sand | 10,695 | 6.5 |
| Dune Sand | 594 | 0.4 |
| Ephrata Sandy Loam | 4,408 | 2.7 |
| Hezel Sand | 11,350 | 6.9 |
| Koehler Sand | 1,149 | 0.7 |
| Kiona Silt Loam | 3,179 | 1.9 |
| Lickskillet Silt Loam | 10,920 | 6.6 |
| Esquatzel Silt Loam | 6,581 | 4.0 |
| Quincy (Rupert) Sand | 43,316 | 26.4 |
| Ritzville Silt Loam | 15,711 | 9.6 |
| Scootney Stony Silt Loam | 2,337 | 1.4 |
| Warden Silt Loam | 28,960 | 17.7 |
| unsurveyed | 24,684 | 15.1 |

The Quincy (Rupert), Hezel, and Koehler soils developed in wind-blown sand. They occupy hummocky terraces and dune-like ridges. They cover over 55,000 acres within the burn, or about 1/3 of the area. These soils often occur in association with areas of dune sand.

The Burbank soil contains a loamy sand surface underlain by gravel. It may occur with areas of dune sand.

The Ritzville, Lickskillet and Kiona soils occur on hill slopes and ridges. They contain a loam or silt loam surface texture. These soils may be subject to sheet and rill erosion. The Ritzville soils are developed on fine-grained, eolian sand and silt, referred to as loess. The Ritzville and Kiona soils are shallow, while the Lickskillet soils are moderately deep to deep.

The Warden soil is a deep soil normally found in foothills below steeper slopes.

The Esquatzel and Scootney soils formed in alluvial deposits. They are deep soils and may be subject to gully erosion because of their position on the landscape.

**Climate and Hydrology:** The climate of the 24 Command burn area is strongly influenced by a rain shadow extending eastward from the Cascade Mountain range. This region, classified as mid-latitude semi-arid, receives less than 8 inches of average annual precipitation and is the hottest and driest portion of the Columbia Basin. Most precipitation falls from October through April and is directly proportional to elevation. Within the burn area, precipitation can vary from as little as 5 inches within Cold Creek Valley (420 feet elevation) to over 14 inches on Rattlesnake Mountain (3,581 feet elevation). Snowfall during December to February accounts for approximately 38% of total precipitation, while the months of July and August typically are the driest. Prevailing winds are from the northwest but occasional strong winds from the southwest also occur. Thunderstorm cells associated with passage of strong cold fronts can produce high velocity winds and localized intense rainfalls. Table 2 indicates what probable rain occurrence and intensity may occur for this region.

**Table 2.** Recurrence Intervals and Precipitation Amounts for Storm Events (Hanford Site Climatological Data Summary 1999 with Historical Data)

| Return Period (years) | 1 Hour Duration (inches) | 24 Hour Duration (inches) |
|---|---|---|
| 2 | 0.22 | 0.70 |
| 20 | 0.44 | 1.26 |
| 100 | 0.58 | 1.61 |

This table indicates that for most probable occurring rainfall events, precipitation would be relatively light and slow.

The fire's hydrologic area can be described as lying within the Pasco Basin of the Columbia River Basin. Perennial reaches of Cold Creek and Dry Creek flow within the burn area. These streams are part of the Yakima River watershed and receive base flows from springs along portions of their reaches. Three major springs - Snively, Lower Snively and Rattlesnake - contribute to less than 3 miles of total perennial flow. Several other small springs occurring along the flanks of Rattlesnake Mountain do not contribute to any substantial surface water flows. Downstream of the confluence of Dry and Cold Creeks, near Rattlesnake Springs, streamflow infiltrates into the sands of the valley bottom. The remaining channel drainages are ephemeral or intermittant, carrying meltwater and storm flows. There are no perennial pour points into either the Yakima or Columbia Rivers from the fire area. The mean annual runoff is low, approximating less than 3% of total precipitation. The basin-wide runoff coefficient is zero for all practical purposes.

The upper slopes of Rattlesnake Mountain influence channel morphology, with the north side inducing steep incised channels and the south side generating more gentle, less discernable channels. Lower flanks of the mountain entrench channels less, allowing the channels to meander and braid and develop flood plains. Any transported flows or sediments along the eastern and northern areas infiltrate and deposit along the flood plains and valley bottom sands. Flows off the west and southwestern areas of Rattlesnake Mountain generally are modified by pipes or diverted for irrigation uses. Only a few ephemeral channels have direct outflow to the Yakima River. However, runoff to the Yakima River is very low if not zero.

Groundwater of the region flows in a general west to east pattern toward the Columbia River. Little groundwater recharge occurs in the Pasco Basin due to limited precipitation. Most precipitation is lost through evapotranspiration with less than 1% recharging groundwater. Studies suggest precipitation may contribute to groundwater recharge in areas where soils are coarse textured and bare of vegetation. In areas of past wildfires, soil moisture measured at depths of 275 centimeters increased when vegetation types changed from sagebrush to grasses. Soil moisture was greatest in late winter. Burned areas are slow to recover from the effects of wildfire, with only sparse shrub cover existing today after wildfires in the 1970s. Throughout much of the shrub-steppe region, microbiotic soil crusts cover some or all of the soil between plants. This microbiotic soil crust facilitates infiltration of precipitation into the soil.

Runoff in the area of the burn is primarily generated by winter precipitation. Warm Chinook winds have been known to cause rapid snowmelt during winter months, inducing runoff and minor flooding in the area. Flooding potential of Cold Creek was calculated by Skaggs and Walters, 1981, for probable maximum conditions. A 100 year flood would be about 3 feet deep, near the confluence of Cold Creek and its tributary Dry Creek. Dry Creek occasionally has crossed State Route 240 during past flood events.

**Wind and Dust storms:** The predominant wind direction within the burn area is from the northwest. However, the strongest winds blow out of the southwest, although less frequently than from the northwest (Fayer et al., 1999). Winds capable of moving sand-sized particles occur approximately 40 days per year. Seasonal changes in the average wind direction are not very large, but changes in the average wind speed can be fairly significant (U.S. Department of Energy, 1988). June has the highest average monthly wind speed (9.2 mi/hr (4.1m/s)), and the prevailing wind direction is from the west-northwest. In November and December, average wind speeds fall to a minimum of 6.0 mi/hr (2.7 m/s), and the prevailing direction is from the northwest. Average diurnal changes in both wind speed and direction can be large, especially during the summer months. In July, hourly average wind speeds range from a low of 5.6 mi/hr (2.5 m/s) between 0900 and 1000 to a high of over 13.0 mi/hr (5.8 m/s) between 2100 and 2200. High-speed, gusty winds can occur any month of the year and reach the greatest velocities during the winter months. The maximum recorded peak gust at 50 ft (15.2 m) above the ground at the Hanford Meteorology Station is 80 mi/hr (36 m/s).

An average of eight dust storms a year that decrease visibility to below 6.2 mi (10 km) occur at the Hanford Meteorology Station (U.S. Department of Energy, 1988). These dust storms last an average of just over three hours, but have lasted as long as 18 hours. The sand and dry soil of the Pasco Basin and local construction and agricultural activities are all sources of airborne dust in the area. Dust storms occur most frequently from March through May and also in September. Dust devils occur frequently on sunny days with light winds and seldom last for more than a few minutes.

Sand drift potential in most of the burn area is the result of winds from the southwest (Glantz et al, 1990). Winds from the west and northwest also have some sand transport potential, but these components are small compared to the influence of southwesterly winds. Direction of sand drift varies with season. In the winter, sand drift potential is dominated by winds from the southwest. In the spring, the sand drift potential is governed by winds from the northwest, but the magnitude of the sand drift is the lowest of all seasons. In the summer, sand drift potential is governed by winds from the northwest. In the fall, the sand drift potential is dominated by winds from the southwest. During all seasons, the sand drift potential is greater after noon than before noon.

A well developed band of sand dunes trending roughly east-west transects a part of the burn area. These dunes formed as a result of strong W-SW winds blowing across the Hanford Site and up Ringold-Koontz Coulee, a natural low point for winds blowing through the basin. Most of this dune field is stabilized, but could likely become reactivated if anchoring vegetation is lost (Fayer et al., 1999).

## B. Reconnaissance Methodology

The purpose of a burned area assessment is to determine if the fire caused emergency watershed conditions. If an emergency is not found, then the assessment stops. If emergency watershed conditions are found, then the magnitude and scope of the emergency is mapped and described, values at risk and resources to be protected are identified, and treatment prescriptions are developed to protect the values at risk. Emergency watershed conditions include both hydrologic and soil factors; typically potential for flash floods and debris flows and deterioration of soil condition, particularly loss of soil structure, leading to a decline in soil productivity. On occasion loss of vegetative cover may also contribute to wind erosion. Table 3 describes terms commonly used in assessing soils and watersheds that have been burned.

**Table 3.** Definitions of terms commonly used in soil and watershed assessments.

| Term | Definition |
|---|---|
| Fire Intensity | Based on temperature, flame length, heat of combustion and total amount and size of fuel consumed. Accounts for convective heat rising into the atmosphere and fire effects on the overstory. |
| Fire Severity | Based on temperature, moisture content of duff and fuels lying on the ground, heat of combustion and total amount of duff and ground vegetation consumed. Accounts for the amount of conductive and radiant heat that goes down into the soil, affecting soil characteristics. |
| Burn Severity | A relative measure of the degree of change in a watershed that relates to the severity of the effects of the fire on watershed conditions. Burn severity is delineated on topographic maps as polygons labeled high, moderate, and low/unburned. |
| Watershed Response | A qualitative degree and/or modeled measure of how a watershed will respond to precipitation. Parameters include pre-existing soil moisture; amount and duration of rainfall; lag time between initiation of storm and peak flow runoff; and peak flow discharge (maximum cfs generated by a storm) and sediment yield. Changes in the characteristics of a watershed brought about by a fire increase the efficiency with which a watershed yields runoff. Burned watersheds shed more water faster. |

Aerial reconnaissance survey and field evaluation were conducted to identify the spatial distribution and extent of the fire severity and resulting burn severity and soil conditions. Field evaluations included, but were not limited to:

- edaphic fire effects;
- areal extent and strength of hydrophobic soil conditions;
- mapping burn severity;
- current channel and culvert capabilities;
- threats to structures and facilities from storm flow and debris;
- threats to human life and property from wind-blown dust.

**Burn Severity:** Burn severity is not the same concept as fire intensity and fire severity as recognized by fire behavior specialists. Fire intensity and fire severity relate to fire effects on overstory and understory vegetation, respectively, while burn severity relates specifically to effects of the fire on soil conditions and hydrologic function (e.g., amount of surface

litter, erodibility, infiltration rate, runoff response). Although burn severity is not primarily a reflection of effects of fire to vegetation, vegetative conditions and pre-fire vegetation density are among indicators used to assess burn severity.

Site indicators used to evaluate and map burn severity include soil hydrophobicity (water repellency), ash depth and color (fire severity), size of residual fuels (fire intensity), soil texture and structure, and post-fire effective ground cover. These criteria indicate fire residence time, depth of litter layer consumed, radiant heat throughout the litter layer and ease of detachability of the surface soil. Using these indicators, burned areas are mapped into three relative burn severity categories. These include high, moderate, and low/unburned.

In some cases there may be complete consumption of vegetation by fire, with little effect on soil and watershed function. In general, the denser the pre-fire vegetation, the longer the residence time and the more severe are the effects of the fire on soil hydrologic function. For example, deep ash after a fire usually indicates a deeper litter layer prior to the fire, which generally supports longer residence times.

Increased residence times promote the formation of water repellant layers at or near the soil surface, and loss of soil structural stability. The results are increased runoff and soil particle detachment by water and transport off-site (erosion). The presence of white ash indicates a hotter fire and more complete consumption of organic matter. Powdery ash without identifiable remnants of twigs and leaf litter also indicates more complete consumption.

Generally there is a close correlation between soil properties and the amount of heat experienced by the soil as well as the residence time of the heat in contact with the soil.

The burn severity map then becomes a basis to predict the hydrologic response of soil to the fire, and the rate of natural revegetation of the site following the fire.

It is important to note that burned area map units are usually mapped at no less than 40 acres in size and may include areas of other burn severity, but which are too small to segregate. Small areas of different burn severity can therefore be present in each map unit.

**Soil Conditions:** Edaphic fire effects were evaluated for several parameters that affect soil conditions. These parameters are hydrophobicity, changes in vegetative ground cover and soil structure, and susceptibility to wind erosion. Hydrophobicity was evaluated by observing the depth and thickness of a water repellent horizon in surface soils where it exists, and duration of a water drop beading on this surface. Changes in vegetative ground cover as affected by the fire were noted and compared to pre-fire conditions. Loss of soil structure is usually indicated by a change to a powdery soil. Soils susceptible to wind erosion were examined in the field to determine if there was an increased risk of erosion. Soil survey maps and air photos were used to assist in making predictions of areas with the greatest risks of wind or water erosion.

**Formation of Hydrophobic Soil:** When soils are heated by fire, one result can be development of a hydrophobic layer on or in the surface soil horizon. This occurs due to volatilization of organic matter in and on the surface soil that have high amounts of lignin and other waxy compounds. After the fire passes, the gasses cool to a waxy coating on soil particles. The effect is similar to putting wax on a car to cause water to bead up and run off. If the hydrophobic layer is thick, or the degree of water repellency is strong, it can seriously inhibit infiltration of rainfall, increase runoff and detach surface soil particles, which increases flooding, erosion and sedimentation. Some soils can be significantly

hydrophobic, even without fire. Vegetation type, amount of organic matter and soil texture are the primary factors that determine whether or not soils will become hydrophobic.

**Watershed Response:** On-the-ground field observations and aerial reconnaissance were conducted to determine the potential for high runoff response. Channel morphology related to transport and deposition processes were noted, along with channel crossings and stream outlets. Observations included condition of riparian vegetation along seeps, springs, and perennial streams and the potential for vegetational loss and/or conversion. Burn severity and changes in soil infiltration were considered for runoff potential. A literature search of local and regional documented studies was conducted and local scientists were consulted about past watershed responses to wildfires.

## C. Findings

**Burn Severity:** The 24 Command Fire burned through shrub-steppe plant communities. While fire intensity varied throughout the burn area, the rapid rate of fire spread through predominantly fine fuels with light fuel loading produced short fire residence times. The resulting burn severity is low throughout the burn area. Exceptions include a few isolated unburned patches that are too small to map separately and spots where individual large shrubs completely burned.. Table 4 is a summary of burn severity acres and percentages by category that was determined for the 24 Command Fire area. A burn severity map is included in Appendix IV.

**Table 4.** Summary of burn severity acres and percentages found on the 24 Command Fire.

| Burn Severity | Acres | Percent |
|---|---|---|
| High | 0 | 0 |
| Moderate | 0 | 0 |
| Low | 163,884 | 100 |
| Total | 163,884 | 100 |

**Soil Conditions, Values at Risk, and Resources to be Protected:** Most of the soils examined were not water repellent. The few areas of water repellant soils were usually associated with large plants that had been consumed or, in a few cases, microbiotic crusts that had been burned. In nearly all cases, the water repellency was weak. Most of the microbiotic soil crusts tested absorbed water readily. Almost all plant and litter cover that was present in the burn area have been consumed by the fire. The loss of vegetative cover has exposed fine sandy and silty soils to ablation.

Nearly all soils within the burn area have a fairly high risk of wind erosion, however, certain soils within the burn area are especially susceptible. Areas with soils having the highest risk of wind erosion are shown on the Wind Erosion Map in Appendix IV. The soils most subject to wind erosion are the Quincy (Rupert), Hezel, and Koehler soils, sand dune areas, and to a lesser extent the Burbank soil. These soils cover approximately 55,000, acres or 1/3 of the burn. Other small areas of soils subject to wind erosion are scattered throughout the burn. These soils have lost most of the vegetation that had been providing stability and some of the microbiotic soil crusts that had offered protection against erosion have also been burned. When soils vulnerable to wind erosion are stripped of vegetation, soil particles become available for transport by the wind through either surface creep, saltation or suspension. Sand particles, especially larger ones, tend to move by surface

creep (rolling or sliding along the ground) and form migrating sand dunes. Finer particles, especially silt and clay, tend to become airborne by saltation and rise high, travel far, and remain in suspension until rain washes them down or when the wind subsides (Chepil,1957).

Dust storms can create serious visibility problems on highways. The greatest risk of dust storms as a result of the fire occurs along State Highway 240 and other roads within the Hanford Site. Wind erosion is not expected to impact water quality in the Columbia or Yakima Rivers as most of the fine soil particles are expected to travel far from the area. Although wind erosion will not threaten water quality, it may hamper vegetative recovery. In many places, vegetation that has started to regrow can be buried or otherwise damaged by the blowing and shifting sand. It may take many years before these areas have re-established enough vegetation to reduce wind erosion.

Microbiotic soil comprised of mosses, lichen and cyanobacteria form a thin crust that greatly aids in stabilizing soil surfaces. These organisms are readily killed by fire, especially when in close proximity to shrubs burned during a fire. Under low burn severity conditions cyano-bacteria occupying shrub inter-spaces have a greater likelihood of survival because they occur below the moss/lichen crust, usually in the top 0.5 cm of soil, where they are protected from the heat. Airborne spores of cyanobacteria from these inter-spaces can innoculate other areas of the burn, enabling rapid recovery of these organisms and providing a modest stabilizing influence on soil surfaces until the moss and lichen crust is re-established.

Recovery of mosses and lichen primarily depends on the area of coverage affected by the fire, how much crust was burned, and amount of rainfall the burned area receives after the fire. Recovery of these organisms after a fire is often much slower than recovery of cyanobacteria, especially if there are few or no unburned islands well within the burned area to function as a propagating source, as is the situation created by the 24 Command Fire. Recovery to the interior of the burned area may take as long as 20 years or greater, depending on the degree and areal extent of mortality cause by the fire.

The potential for sheet and rill erosion is expected to increase within parts of the burn area. The soil most susceptible to this type of erosion are the Ritzville, Lickskillet, and Kiona soils which occur on steeper slopes. These soils will have accelerated erosion until the vegetative cover returns to normal. Other soils within the burn have a lower risk of water erosion. It may take several years before the vegetation recovers sufficiently to allow sheet and rill erosion to return to pre-fire rates.

Runoff may increase on some of the slopes. Reduced vegetative cover and soil crusting that develops from rain drop impact will cause lower infiltration rates. Soils higher in silt will be more likely to develop surface crusts than sandy soils. Because of increased runoff, the potential for gully erosion will increase in low-lying areas. Due to their position on the landscape, the Esquatzel and Scootney soils are most susceptible to gully erosion.

Sedimentation may occur in some of the springs within the burn because of increased erosion in the contributing watershed.

**Watershed Response, Values at Risk, and Resources to be Protected:** Because burn severity was low over the entire burn area, infiltration rates are not expected to decrease due to soil hydrophobicity. Areas with hydrophobicity were spotty and discontinuous and would not contribute to overland flow. Loss of vegetative cover will decrease infiltration rates for approximately the next 3 years. However, existing conditions prior to the fire already contributed to reduced infiltration rates. These conditions include sparse

vegetation throughout the burn area, rocky slopes and shallow soils on Rattlesnake Mountain, and, on the southwest flank of Rattlesnake Mountain, compaction due to grazing. Prior runoff and flooding events have been recorded during winter months from snowmelt over frozen soils when vegetation has negligible effects to runoff. Therefore, the overall relative water yield increase due to the fire is expected to be minor and not exacerbate flooding events. In areas where sagebrush cover was lost, minor increases in groundwater recharge may occur due to conversion to grasses which evapotranspire at lower rates and from shallower soil depths than sagebrush. The microbiotic soil crust cover, where undisturbed, should continue to facilitate infiltration.

Some rill erosion is expected on steep slopes of the northern and eastern flanks of Rattlesnake Mountain. These sediments may be transported down into the stream network of Dry Creek, Cold Creek, and their springs during runoff events. Most entrained sediments would be deposited along the lower gradient floodplains and sandy valley bottoms. Localized effects should be expected but overall effects to the watershed would be minor. Additionally, riparian vegetation was lost at Snively, Lower Snively and Rattlesnake Springs. An initial flush of sediment and ash is expected to these springs and perennial streams from affected riparian areas but amounts would be minimal. Because these systems do not have direct outlets to the Yakima River, no effect from sediment to the river is expected. Ephemeral streams on the south side of Rattlesnake Mountain may transport an initial flush of sediment and ash into the Yakima River but because of the small spatial size of these subwatersheds, any inputs would have immeasurable effects. Water temperatures may increase along perennial reaches and springs due to loss of shade-providing riparian vegetation.

A retardant load was dropped over Snively Springs contaminating a forty foot swath over water sources. Total chemical input was small. Mitigation for fire retardant effects on aquatic organisms is to avoid drops within 300 feet of waterways where possible. However, it is recognized that some contamination is unavoidable due to drift and the need to protect other resources from fire. After recent studies, retardant components were reformulated this past spring to minimize toxic effects to aquatic organisms. No Federally listed threatened or endangered species are reported for Snively Springs. Some unknown localized effect to aquatic organisms may occur but because Dry Creek's flow infiltrates in valley sand bottoms, no effect to the Yakima River is expected.

Overtopping of an engine tank resulted in a small amount of suppression foam spilling into a pond at Rattlesnake Springs. This foam solution was diluted by a full tank of water and further diluted by the pond's volume. Cold Creek infiltrates into valley sand bottoms just below Rattlesnake Springs so no water surface transport of the pollutant occurred beyond this point. Some unknown localized effect to aquatic organisms may occur in the pond but the overall effect to water quality is minor.

## IV. RECOMMENDATIONS

### A. **Management** (specification related)

#### 1. **Install drift fencing along roadways maintained by DOE-Hanford to control blowing sand.**

Situation: Stabilized and quasi-stabilized sand and silt areas that were burned have lost all or most of their protective vegetation. Wind will increase erosion of sand and dust from these source areas beyond pre-fire ablation conditions, leading to reactivation of sand dunes in portions of the burned area. This will cause sand dunes to migrate in an east to northeast direction based on direction of past dune migration. Dunes may migrate onto roadways, increasing the risk of vehicular

accidents in and adjacent to the burned area, including risk of human injury and/or fatalities.

Recommendation: Install 9 miles of drift fence along DOE roadways.(See Part F Specification: S-1b Public Safety: Drift Fencing.)

**B. Monitoring** (specification related)

**1. Inventory mortality and monitor recovery of microbiotic soil crust.**

Situation: The degree and extent of microbiotic soil mortality within the burn is unknown. With few unburned islands within the burn to function as propagation sources recovery may take decades. Soils that were previously partially stabilized by vegetation and microbiotic soil crusts may become more now unstable and more readily susceptible to wind erosion due to the loss of vegetation and possible microbiotic soil crust mortality. Increased soil erosion will lead to the occurrence of dust storms, which will increase the risk of vehicular accidents on highway 240 and roads within the Hanford Site, including risk of human injury and/or fatalities.

Recommendation: Inventory microbiotic soil crust (MSC) mortality and monitor recovery within the burn area to determine the degree and extent of mortality. The inventory and monitoring should be conducted during the first year with monitoring continuing through the second year. The information learned will be made available to DOE/USFWS to determine whether or not mitigation action is necessary. Mitigation would be to inoculate dead zones with microbiotic soil specimens composed of similar species collected from an unburned area with the same soil types. Any continued monitoring and/or mitigation needs will be submitted as a supplemental funding request. (See Part F Specification M-1b Monitoring: Microbiotic Soil Crust.)

**C. Management** (non-specification related)

**1. Post dust hazard warning signs along state highways and DOE roads and evaluate the need to have advisories recorded on radio station AM 530.**

Situation: Stabilized and quasi-stabilized sand and silt areas that were burned have lost all or most of their protective vegetation. Wind will increase erosion of sand and dust from these source areas beyond pre-fire ablation conditions, leading to reactivation of sand dunes and development of dust storms in portions of the burned area. In particular, dust storms in and immediately downwind of these eolian sources will greatly diminish visibility. Motorists driving on State Highway 240, access roads to DOE sites in the Hanford Site, and immediately downwind of the burned area are at an increased risk of experiencing dust storms and sand sheet movement across these roads. There is an increased risk of vehicular accidents in and adjacent to the burned area, including risk of human injury and/or fatalities. The BAER team recommended to WaDOT that permanent, changeable dust warning signs be installed on highway 240 and also suggested that an advisory message be played on radio Am 530. WaDOT said that they would prefer to close the road when visibility got really bad and post temporary dust warning signs as needed.

Recommendation: Convene a multi-agency meeting to assess the need, type, and number of road hazard warning and safety messages to be posted along state highways and DOE access roads crossing the burned area of the Hanford Site.

The need to implement radio advisory messages should also be assessed. Participants should include at a minimum the USFWS, DOE-Hanford, and the Washington State Department of Transportation.

**2. Maintain restricted access to the ALER to protect microbiotic crusts from disturbance.**

Situation: Microbiotic soil crusts offer protection from soil erosion and increase infiltration of precipitation. These organisms are vulnerable to disturbance from vehicles and foot traffic. Prior to the fire many roads had restricted access which also limited cross-country foot traffic.

Recommendation: Close roads that were opened for fire access. Maintain restricted access on all other roads. Maintain educational awareness about the need to minimize soil disturbance when hiking in the ALER.

**3. Clean and maintain all culverts in areas affected by the fire.**

Situation: Many of the culverts on roads within the fire area are completely plugged with sediment and debris. These culverts will not function as designed during high flows, causing the roads to wash out.

Recommendation: Assess all roads within the burn area, clean existing sediment and debris from culvert inlets and outlets, and replace culverts as necessary.

**D. Monitoring** (non-specification related)

**1. Monitor roadways maintained by Washington DOT to determine if drift fencing is needed to control blowing sand.**

Situation: Stabilized and quasi-stabilized sand and silt areas that were burned have lost all or most of their protective vegetation. Wind will increase erosion of sand and dust from these source areas beyond pre-fire ablation conditions, leading to reactivation of sand dunes in portions of the burned area. This will cause sand dunes to migrate in an east to northeast direction based on direction of past dune migration. Dunes may migrate onto roadways, increasing the risk of vehicular accidents in and adjacent to the burned area, including risk of human injury and/or fatalities. The BAER team recommended to WaDOT that drift fences be installed along the southwest side of the portion of highway 240 that crosses the dune fields. WaDOT stated that they thought the sand would blow all the way across the road and not accumulate on the roadway. They preferred to monitor the sand movement and install drift fences if necessary.

Recommendation: WaDOT should monitor sand movement across state highways during wind events to determine where and how much sand is moving across and accumulating on the roadways. Evaluate the need to install drift fences along roadways. Evaluate location and distribution of reactivated sand transport, and its potential impact on road system. (This could be done by comparing time sequence of air photos.) If it is determined that drift fences are needed, a supplemental funding request can be submitted.

## V. CONSULTATIONS

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**U. S. DEPARTMENT OF THE INTERIOR**
**BURNED AREA EMERGENCY REHABILITATION TEAM**

**24 Command Fire**

**OPERATIONS ASSESSMENT**

## I. OBJECTIVES

- Identify, inventory, and map fire suppression impacts on jurisdictions affected by the fire.
- Specify rehabilitation measures to mitigate fire suppression impacts.
- Coordinate with local agencies so that specification recommendations are consistent with agency objectives.
- Protect natural and cultural resource values during rehabilitation efforts.

## II. ISSUES

- Critical natural and cultural resources.
- Extensive soil disturbance on highly erodible soils from fire suppression activities.
- Removal of fire retardant on Department of Energy (DOE) structures (LIGO).
- Removal of burned DOE Fire engine from U.S. Fish and Wildlife Service (FWS) land.
- Safety associated with three hazzardous openings located within the fire area.
- Damage to fences within fire perimeter associated with fire suppression actions.

## III. OBSERVATIONS

### A. Background

The 24 Command fire, initially referred to as the Two Forks Fire, or the SR24-Mp36 Fire started on Tuesday, June 27, 2000 about 1330 hours as a result of a fatal motor vehicle accident on state route (SR) 24, about 2 miles west of the intersection of SR 240. Driven by high winds and temperatures, and low humidity, the fire quickly spread over the next two days and consumed 163,884 acres of Federal, state, and private lands.

The fire burned in a sage/grassland fuel type under extreme weather conditions. On the afternoon of July 27th the fire spread mostly from northwest to southwest and was pushed by 35 mile per hour winds. Rates of spread were observed to be about 60-80 chains per hour (3960-5280 ft/hr) with flame lengths of about 5-20 feet. The morning of the 28th the fire was estimated to be about 20,000 acres in size and continued to grow throughout the day. Beginning about 1700 the fire behavior noticeably increased with flame lengths reported to be 15-20 feet, and rates of spread of 100-200 chains per hour (6,600-13,200 ft/hr). By about 1800 on the July 28th, the fire was about 40,000 acres and the power of the fire became stronger than the power of the wind, and it became plume dominated. This is about the time when the fire encountered a high concentration of fuels and eventually moved into the populated outskirts of Benton City and West Richland consuming eleven

residential structures and numerous out buildings and vehicles. On July 29th there was approximately 160,000 acres burned.

The 24 Command fire was contained on July 1, 2000 at 1800 and controlled on July 2, 2000 at 1800, and had approximately 750 fire personnel assigned at the peak of fire activity.

## B. Reconnaissance Methodology and Results

On June 30-July 5, 2000, BAER Team personnel began evaluating resource impacts caused by the suppression effort. Team members did reconnaissance from the ground and the air, as well as obtained information from local sources. Information was also gathered from interviews with Division Supervisors, and from the Situation Unit attached to the Fire Incident Management Team.

## C. Findings

The table below summarizes by agency the acreage of the fire, type of suppression line, and length of line to be rehabilitated.

| ADMINISTRATIVE UNIT | FIRE ACREAGE | SUPPRESSION LINE TYPE | DOZER LINE |
|---|---|---|---|
| U.S. Fish and Wildlife Service | 78,732 | Dozer Line | .45 |
| Department of Energy | 60,254 | Dozer Line | 25.97 |
| Private | 20,225 | Dozer Line | 3.47 |
| State | 3,633 | Dozer Line | 10.41 |
| Bureau of Land Management | 980 | Dozer Line | .5 |
| McGee Riverlands | 60 | **----** | **----** |
| **Totals** | **163,884** | Dozer Line | **40.8** |

Rehabilitation of suppression line is necessary to protect habitats from noxious weed infestation, visual intrusion on the landscape and to minimize fragmentation of ecological areas. Monitoring of suppression lines is necessary to determine the need for future noxious weed mitigation needs. Dozer lines within the burned area on lands managed by FWS and DOE will be treated according to methods described in the Hanford Site Biological Resource Management Plan (HSBRMP, 1996). Private land owners to the west of the fire (Robyn Robert) initially stated that he did not want dozer lines on his private lands rehabed. At the agency close out he stated that he may be interested in getting it done. Private land owners will need to be contacted prior to rehab efforts to identify if rehab work will be done on their lands. Dozer line along Hwy #225 will be treated in the same manner as HSBRMP Category 1 sites at the request of Bureau of Land Management and Washington Department of Fish and Wildlife.

There are five types of suppression impacts to be considered:

- Graded Roads: Existing roads which were graded to act as suppression line.
- Dozer Line on Private Lands: Dozer line built on private lands on the west end of the fire.
- Dozer Line on State/BLM: Fire break built along Hwy #225.
- HSBRMP Category 1: Fire break built on ALE or DOE lands in areas which require no restoration, but which may receive noxious weed mitigation.
- HSBRMP Category 3: Dozer line built on FWS or DOE lands which require restoration and revegetation.

Graded Roads: Three road sections in the Snively springs area, off of road #118 require revegetation and noxious weed monitoring where a push berm was created as a result of the road being graded. Should exotic plants be identified along the graded road edge, the application of herbicide, plant pulling or cultural remediation treatments should occur. See specification for noxious weed monitoring and native plant reseeding.

HSBRMP Category 1, Non-Habitat of Concern, and Dozer Line on State and BLM lands: Noxious weed monitoring should occur in these areas. If noxious weeds are identified along the fire breaks, the application of herbicide, plant pulling or cultural remediation treatments should occur in accordance with agency IPM practices. See specification for noxious weeds.

HSBRMP Category 3, Late -Successional Shrub-Steppe: Three areas identified on the Suppression Impacts GIS data layer require rehabilitation to a more natural condition. On DOE lands a four wheel drive tractor with a weighted drag or a gannon box attachment should drag the suppression lines and push berms to reduce the berm to contour. A drill seeder should apply native plant seed to meet HSBRMP specifications. If noxious weeds are identified along the dozer line, the application of herbicide, plant pulling or cultural remediation treatments should occur. On FWS lands a 20 person hand crew should pull the berm on the dozer line and rake the disturbed area to contour. Site selected plant material should be used to rehabilitate the disturbed area.

The following are other suppression impacts observed. During the course of the suppression actions, one of the structures on DOE land was hit by a Load of retardant. This left a red stain on one of the tunnels at the LIGO facility. Fences located within and around the fire area were cut to allow access for fire suppression vehicles. A Type IV engine was burned over during the fire and is currently disabled and located on FWS land. During a reconnaissance flight BAER staff observed an open mine shaft or well just south of the fire origin which posses a safety hazzard to those in the area. There is also two other concrete conical hazzardous openings located around the Nike missile site .

Many of the roads within the fire area that were used for suppression actions are now impassible due do the amount of lose powdery soils resulting from the destruction of soil structure in the upper horizons. Some of these roads have been signed and closed for the present time.

## IV. RECOMMENDATIONS

### A. **Management** (specification related)

- Dozer Line Rehabilitation. Rehabilitate dozer lines and other sites directly or indirectly impacted by fire suppression activities (BAER Spec F-1 Suppression- Dozer Line Rehabilitation). Dozer line rehab should be done at a later date due to the degraded

soil conditions at this time. This activity should take place in the late fall or early winter when soil moisture content is higher.

- **!** Infrastructure Repair and Replace. Remove retardant from LIGO Tunnel with mobile power washer (BAER spec F-3b Infrastructure Repair/Replace).

- **!** Construction/Structural Cleanup. Remove burned DOE fire engine from FWS land. (BAER spec F5 Suppression Equipment Removal/Disposal).

- **!** Construction/Structural Stabilization and Cleanup. Mitigate mine shaft hazard with safety fence and hazard signs (BAER spec S1-c Public Safety - Ground Hazzards).

- **!** Fence Repair. Repair suppression damaged fence around perimeter of the fire and along highway #240 (BAER spec F-3a Fence Repair/Replace).

**B. Management** (non-specification related)

- **!** Continue to review rehabilitation specifications with operators and other personnel associated with implementation of the BAER Plan to insure rehabilitation specifications are clearly understood for protection of sensitive resources and land productivity..

- **!** Guarantee safety of personnel assigned to rehab operational assignments in the fire area.
- **!**
- **!** Monitor suppression related damage on dirt roads following fall and winter moisture events to see if additional rehab measures are necessary.
- **!**
- **!** Evaluate necessity of interior fences on FWS land and make management decisions to remove or repair them.

## V. CONSULTATIONS

Personal Communication with:
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## VI. REFERENCES

USDI, 1995. BAER Field Team Leader Reference Book
DOE, 1996. Hanford Site Biological Resource Management Plan

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